Sub-Saharan Africa Transport Program

The Road Maintenance Initiative
Building Capacity for Policy Reform

Volume 2. Readings and Case Studies
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Foreword

The constraints that inefficiencies in the transport sector impose on economic development in Sub-Saharan Africa have long been recognized and have been recently underscored in the Long-Term Perspective Study of Sub-Saharan Africa prepared by the World Bank. Despite the great experience of donors in financing transport projects, the effectiveness and sustainability of past programs designed to increase the performance and efficiency of transport services have been disappointing.

In this context the World Bank, in close association with the UN Economic Commission for Africa (ECA) and several primary donors, has developed the Sub-Saharan Africa Transport Program (SSATP). The main objective of the program is to improve transport efficiency through major policy reforms. It also provides the ECA with substantive inputs for the preparation of the Second UN Transport and Communications Decade for Africa, which will serve as a framework for mobilizing energies and resources to improve the performance of the transport sector and pursue its development. The program is an excellent example of the cooperation that can be achieved by African countries and international agencies in addressing difficult policy issues through a regional approach.

This book is one of three volumes that report on a series of six subregional policy seminars organized by the World Bank and the ECA under the Sub-Saharan Africa Transport Program to address the problems and issues of road deterioration and maintenance. These policy seminars provided a forum in which policymakers from different countries, leading experts in development, and World Bank staff were able to share ideas and experience concerning development policies that relate to road transport and maintenance.

These reports are now being published for widespread distribution as a guide to defining future activities, programs, and initiatives for reforming road maintenance policies in Africa. Recognizing that policy reform is a complex, dynamic, and long-term task, all who participated in the seminars see the effort and these reports as the beginning of a long process.

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Preface

The present process of economic reform in Sub-Saharan Africa has far-reaching implications for the transport sector. Against a background of a deteriorating transport system and the high cost of providing new road infrastructure, issues of transport policy become especially prominent. These issues are inherently difficult to deal with because transport is almost always an intermediate output. As a first step toward addressing these issues and helping governments improve their own capacities to address transport problems, the Sub-Saharan Africa Transport Program (SSATP) was initiated in 1987.

The Road Maintenance Initiative (RMI) is one of the key components of the SSATP. It has been envisaged as a project with a five-year duration (1987-92), in two phases. Phase I consisted of six subregional policy seminars. Representatives from forty-two Sub-Saharan African countries attended one of the seminars held between May 1989 and February 1990 in Harare, Accra, and Addis Ababa (for anglophone countries) and Dakar, Libreville, and Antananarivo (for francophone countries). Country delegations to these seminars normally included ministers of public works, heads of highway departments, and senior officials from ministries of planning and finance. The objectives of Phase I were to develop awareness of the consequences of neglect of the road network, to recognize the policy nature of the problem, to identify key areas for policy improvement and endorse related policy options, and to engage delegations in the preparation of policy reform plans for their own countries through Policy Action Planning exercises. Phase II will include facilitation support for national activities directed toward improving national capacity to deal more effectively with important policy issues and reforms. Activities will consist of country-level development of Policy Action Plans for highway maintenance and will be designed to create a broad national commitment for policy changes and institutional reforms. Implementation of the Policy Action Plans with monitoring and evaluation would follow Phase II.

The Phase I policy reform seminars were organized by the SSATP Unit in the Infrastructure Division of the World Bank's Africa Technical Department and by the Infrastructure and Urban Development Division of the Economic Development Institute of the World Bank in close collaboration with the ECA. The SSATP has been made possible by the support, financial and otherwise, of a number of international donors. The RMI and the policy seminars, specifically, benefitted from donor assistance from the governments of France, Germany, Norway, Sweden, Switzerland, and the United Kingdom. The Carl Duisberg Gesellschaft, the International Labour Office, SETRA, and the Transport and Road Research Laboratory provided help and guidance.

The RMI seminars were conducted in two parts, beginning with an introduction to and discussion of, the regional issues in road maintenance. Three broad areas were considered: planning, budgeting and financing; operational efficiency; and institutional reform and the development of human resources. Following two days of presentations and discussions, individual country teams explored and applied the Policy Action Planning method, which was
presented in workshop exercises designed to demonstrate a systematic procedure for prioritizing problems and developing policy reform action plans to resolve them.

The documentation for the Phase I seminars are being published in the following three reports:

- Volume 1: Building Capacity for Policy Reform
- Volume 2: Readings and Case Studies
- Volume 3: Guidelines for Policy Action Planning

The production and editing of these reports are a joint collaborative effort of the Infrastructure Division of the Africa Technical Department and the Infrastructure and Urban Development Division of the Economic Development Institute of the World Bank.
Overview of the Seminars

This book reports on the first phase of the Road Maintenance Initiative (RMI), a project under the Sub-Saharan Africa Transport Program (SSATP). The SSATP is a joint program of the World Bank and the United Nations Economic Commission for Africa (ECA) and is sponsored by a number of bilateral financing agencies. The objectives and modus operandi of the SSATP are:

- An emphasis on policy responses to key transport sector issues and on strengthening capabilities for policy development at the national and regional level
- Implementation through a series of discrete components (each defined in terms of specific outputs) in partnership with development agencies and African institutions, with participation by African experts and advisers
- A light management structure with flexible arrangements for participation and each component defined up to closure with specific outputs.

Activities of the SSATP are closely coordinated with the preparation of the UN Second Transport and Communications Decade for Africa, 1991-2000.

Within the general framework and objectives of the SSATP, the Road Maintenance Initiative (RMI), focuses on road maintenance. The RMI originated in the need of African countries to halt and, it is hoped, reverse the massive deterioration of the African road networks. The critical situation is illustrated by the following facts.

- About half the region’s paved roads and 70% of its unpaved roads are in only fair to poor conditions and require substantial repairs.
- The region’s losses in increased road transport costs, caused by lack of maintenance, are estimated at $1.2 billion a year.
- According to World Bank estimates, the cost of overcoming Sub-Saharan Africa’s road maintenance backlog is US$5 billion, and about US$1.15 billion will be needed annually over 10 years to reconstruct priority roads to good condition and to provide routine and periodic maintenance for good roads to prevent them from further deterioration.

The RMI’s program is based on two essential postulates:

(a) The core problem of road maintenance is not rooted in technical matters but is political and institutional.

(b) Any change in policies, to be effective, must be rooted in a firm awareness, at the highest level of government, of the importance of road maintenance.

The aim of the RMI is to facilitate policy change. The lack of success with externally initiated or directed reforms, highlights the need for alternative approaches that African governments can use to improve their capacity to deal with complex policy reforms themselves. The RMI addresses this need through a more
structured, multiphase program over 5 years, to be closely coordinated with programs and projects financed by international and bilateral lending agencies in order to maximize effectiveness.

The first phase of the RMI consisted of six subregional policy seminars at which senior policy makers, including ministers, discussed road deterioration, and exchanged experiences and views on various policies, their appropriateness in the African context, and how best to introduce them through collaborative preparation of national action plans. Each Sub-Saharan African country sent a team of three to five officials from ministries related to planning, financing, budgeting, and implementation of road maintenance and rehabilitation programs. The country teams were normally led by the minister or deputy minister responsible for road maintenance.

The seminars were preceded by careful preparation over a two-year period. A survey of the road maintenance and road deterioration situation in each country was carried out, and materials were prepared: eight Policy Issues Papers that addressed the main issues, focusing on the nature of the issue and the relevant policy options; several case studies illustrating African examples of successful policy reform; a module on Policy Action Planning, with guidelines and examples for developing action plans for policy and institutional reform, and, for each country, a Country Review and Analysis that country teams could use to identify the key policy issues and assess the relevance and applicability of policy options. The seminars themselves consisted of two parts. The first concentrated on a discussion of key policy issues with the aim of building commitment to policy change. The second presented an approach to Policy Action Planning and gave country teams an opportunity to explore and apply it to their national situations.

The issues covered in the seminar, grouped under three themes, and the participants' reactions, are summarized below.

A. Planning, Financing and Budgeting

- Developing a network-based framework for planning. Currently, in most countries, planning and programming road expenditures is divided between new investments and maintenance. This hampers efficient allocation of scarce resources and has resulted in a significantly lower allocation of total road expenditures for road maintenance than required and economically justified. Participants agreed that the lack of a unified, or network-based, framework for planning made it difficult to allocate resources rationally. Even in Senegal, which is devoting 80 percent of road funds to maintenance, available finance is spread thinly among highways, and as a result, few, if any, of the roads receive the attention they need.

- Collecting and disbursing funds. Not only must the total level of funding be adequate, but it is also vital that resource flow be regular and dependable. When budget mechanisms consistently fail to provide the amount required in a dependable manner, the setting up of a Road Fund, rigorously managed and monitored and funded with earmarked resources, may be the best option. Participants generally favored this approach, although in some cases national budgetary procedures did not allow for the earmarking or creation of special funds, and in other cases such funds were not deemed necessary. Participants also pointed out that fairness, and efficiency in cost recovery, posed questions regarding the imposition of tolls or special taxes on trucks with heavy axle loads -- which are especially destructive of pavements -- in both national and international transit traffic.

- Performance budgeting. Efficient and transparent budgeting procedures require the establishment of quantifiable objectives and quality controls and the implementation
of institutional changes to make possible financial as well as technical audits of road maintenance works. Participants agreed that, in general, ministries of public works were not organized for or concerned with the efficient use of allocated resources. Performance budgeting could increase accountability and provide an important image of effective planning and good use of resources, thus increasing the likelihood of attracting higher levels of funding.

B. Operations and Management

- **Reducing force account and increasing contracting.** Almost exclusive reliance on public sector force account operations has led to over-staffing, lack of incentives for capable staff, and rigid controls and rules that inhibit staff initiatives in adopting cost-effective management solutions. Governments accepted that, in situations of labor shortages and huge backlogs of road maintenance, the increased use of contract maintenance could be a viable option. Domestic contracting and construction industries, however, are often underdeveloped and would require assistance and encouragement to strengthen the industry. Key factors in the development of the industry would be stable markets and supportive policies, training programs, simplified procurement and contract procedures, timeliness and reliability of payment procedures and, possibly, joint ventures with international firms. Such a transition would have to be planned and phased over time and requires serious commitment and a long-term view. A combination of direct labor and contract work, with the proportion of contract work increasing over time, is indicated. Local contractors rarely have the capital for equipment but in some cases governments have leased them equipment. Many roads departments may lack the necessary skills mix for this type of arrangement and would need to address this in their staff development and recruitment programs.

- **Increasing use of labor-based operations.** Constraints on resources and the availability of under-employed or unemployed labor that can be mobilized for up to $4.00 daily often makes the adoption of labor-intensive maintenance techniques economic. Several countries reported positive results, including reduced costs and increased maintenance effectiveness. Success depended on terrain, population density and climate. Labor-based approaches, however, also require the decentralization of supervision, administration, contracting, and payment authority, as well as technical assistance and staff training. Participants concluded that this may be the only feasible approach under conditions of extreme resource constraint. Further, they agreed that there were considerable economic and social advantages, including savings in foreign exchange. Also it could provide for the use of rural and communal groups in the execution of the work.

- **Reducing publicly owned equipment fleets.** Maintenance managers have been overburdened by the need to keep up huge -- and often incompatible -- equipment fleets. Availability and utilization is very low: in some countries only about 20% of the national road maintenance fleets is in working condition. The result are fleets with unnecessarily high operating costs. This represents a large wasted investment, much of which is in foreign exchange. Smaller fleets with higher availability and utilization rates would save money while raising productivity and reducing unit costs and management overhead. The reforms indicated include autonomous agencies responsible for equipment management, commercially run equipment pools, centralized
spares purchase, and contracting out equipment maintenance (as well as road maintenance tasks as mentioned above). The lack of standardization emerged as a major concern of participants, who also saw the potential for addressing this issue through modified policies of external aid agencies and better planning and packaging of their programs for external aid.

C. Institutional Reform and Human Resources Development

- **Institutional reform.** Most road authorities in Sub-Saharan Africa inherited institutional structures, procedures, and systems from pre-independence days, and these are now in urgent need of review and revision to make them more directly relevant to current circumstances. As referred to above, the delivery of parts of the road maintenance program through contractors would help achieve some desirable changes. Also, some of the institutional systems such as local procurement procedures are in need of streamlining. Participants acknowledged the need for changes that are tailored to the specific situations and needs of countries. They felt that such changes should aim at a progressive reduction of the role of the state, with the emphasis on a leaner and more efficient government organization. Separate, autonomous road authorities seemed to be necessary, at least during the coming decade while roads systems pass through a crisis period.

- **Improving staff motivation and utilization.** Apart from the issues relating to institutional organization and structure, participants agreed that human resource development is one of the most critical factors in addressing road maintenance. At present, constraints on personnel utilization and development caused by inappropriate and inflexible public employment policies result in serious problems: lack of staff accountability; difficulties in retaining competent staff; loss of good staff to the private sector; lack of on-the-job development and motivation; lack of application of previously learned skills, stagnation, and waste of expensive education and training; and generally low levels of manpower productivity. One advantage of autonomy in road agencies is that they can avoid becoming financially overburdened with unneeded staff and thus increase funds applied to operations, supplies, and equipment. They can also promote staff on merit and can remove nonperformers. Creating a personnel unit and strengthening line managers are key to this issue. Line managers will need skills in setting objectives, allocating work, delegating, setting standards, establishing accountability, and providing on-the-job training, recognition, and feedback. Participants also identified as other important contributions to improved staff performance: giving staff greater responsibility, increasing motivation, establishing productivity bonuses, and improving opportunities for training. Regarding training, they endorsed the idea of reinforcing national training programs and, if necessary, creating regional training structures. Participants concluded that before defining their needs for technical assistance, they should make full and efficient use of qualified and experienced local staff and, to the extent possible, deploy them in key planning and decision making roles. Expatriates should be assigned to temporary short-term positions with clear terms of reference, measurable and monitorable objectives, and strong incentives for training local staff.
Policy Action Planning

The second part of the seminars was the conduct by country teams of Policy Action Planning (PAP), following the approach developed by the Carl Duisberg Gesellschaft. The approach consists essentially of three stages:

- Road maintenance constituencies identify the constraints and functional deficiencies the sector faces. From this analysis, priorities are determined and then transformed into concrete objectives.

- Participants define the measures needed to achieve the objectives. These measures are critically screened taking into account financial, human, and institutional constraints. An action agenda is established.

- Responsibilities, resources, and the time frame for implementation are determined.

By bringing out the agendas of all the constituencies involved and showing the areas of possible conflict, the PAP process ensures that both the resource-allocating agencies and the line agencies have a realistic framework for seeking compromise and consensus.

The seminars were successful in introducing the Policy Action Planning concept and demonstrating its value in policy formulation and decision making. Participants found PAP's focusing and consensus-building attributes extremely valuable; the process was also praised as a powerful tool for bringing issues to the surface and making choices between them explicit. The PAP's cross-ministerial structure was also found particularly valuable. Participants suggested that the PAP as presented would benefit from full-scale testing in a Sub-Saharan African country and that one aim would be to find ways to streamline and simplify the process.

The participants found a surprising level of commonality in the road maintenance problems each country faced and in their priorities in ranking these problems. In the anglophone seminars, those countries more committed to maintenance, with better institutions and financial resources, tended to identify planning, programming, and budgeting, and improvement of staff capabilities and skills as the overriding issues; countries at the other extreme of the spectrum, particularly the poorest countries, appeared to focus more on the level of funding as the main issue. In the francophone seminars, the pattern was less well defined. The better-off countries focussed on the planning and use of funds, while at the other extreme priorities were diffused over a larger number of issues.

Follow-up

The follow-up phase (Phase II) of the RMI will support the preparation of policy reforms in a limited number of areas that are central to better management of road infrastructure. That phase will also build up the capacity of selected training institutions, such as ESAMI, to provide process assistance to policy reform in road administration and management.

Phase II would be:

- Driven by country initiatives under the aegis of an interministerial committee or steering group
• Targeted at a limited number of important policy issues requiring action by several departments or agencies

• Closely coordinated with ongoing and planned programs by external financiers

• Designed in harmony with the priorities established by the National Coordinating Committee that will be responsible for the preparation of the country’s contribution to the Second Transport and Communications Decade.

The start-up of Phase II involves invitations to preselected countries and joint studies by the World Bank and lead bilateral agencies to assess the country requests and make a decision. Burkina Faso, Cameroon, Madagascar, Mozambique, Nigeria, Rwanda, Sierra Leone, Tanzania, Uganda, and Zimbabwe have been identified as candidates for Phase II.
Introduction

The inefficiency of the transport sector in most countries in Sub-Saharan Africa is a major impediment to economic growth and national and international trade. Sector needs for improvement are vast. Systems suffer from inadequate maintenance, burdensome regulation, and inefficient operations—resulting in high costs and unreliable services. Furthermore, managers and staff are relatively untrained and institutions capable of addressing these problems are lacking throughout the region.

The World Bank/ECA Sub-Saharan Africa Transport Program (SSATP) aims to help African governments improve and sustain transport efficiency through policy reform and institutional improvement. It is being designed and implemented at a time when collaborative efforts between the Bank and ECA are necessary to exchange views and experiences relevant to the preparations for a second UN Transport Decade. It comes at a time when governments are becoming more receptive to policy reforms to improve their overall economic development performance.

The SSATP is made up of a number of projects covering specific important aspects of transport policy. Each project includes elements of:

- research, to deepen knowledge in specific areas where the basis for policy advice is not yet known;
- surveys, to provide or improve the data basis for policy analysis in the region;
- policy analysis and development, to identify policy responses, to build consensus and to engage policy makers and senior sector managers in the formulation of action plans for reform; and
- human resources and institutional development, to build capacity and enhance manpower in order to improve the operation, organization, and management of transport institutions.

Road Maintenance and Deterioration

Countries in sub-Saharan Africa are losing capital through the massive deterioration of their roads. Large networks, built at a great expense, have been undermaintained and are often more heavily used—and abused—than expected. If this deterioration is allowed to continue, it will accelerate as old pavements crumble and newer ones outlive the grace period following construction when neglect has little visible effect.

An economy cannot grow while it is neglecting road maintenance. In fact, letting roads deteriorate simply means that road users’ vehicle operating costs and later restoration costs to the governments exceed many times any “savings” made in disregarding road maintenance. This has been demonstrated in the World Bank’s report on Road Deterioration in Developing Countries. Local highway officials, in most cases, recognize the dimensions of the problem but have been unable to arrest the process while it could still be done at reasonable cost. Now, the task facing many governments is to salvage valuable infrastructure that has severely decayed, while at the same time protecting newer vintages of roads from a similar fate. This task has major policy, institutional and financial dimensions.

Road networks in 39 countries total over one million kilometers—about 300,000 kms constitute main networks of paved and gravel roads. To appreciate the burden of road maintenance in each country, we must note that the ratio of main road network length to GNP ranges from 0.4 to 14.5 km for every million dollars of GNP. These ratios are highest in the developing world, making road maintenance financing especially difficult considering also that normally the foreign exchange component is about 50%. Even under the best management and institutional arrangements road network management is costly relative to the financing capacity of Sub-Saharan African countries.

After these road networks are constructed, the essential works of routine maintenance and resurfacing are frequently postponed. Among the competing demands for resources, new construction or reconstruction may seem the more attractive and perhaps more expedient choice because new roads bring quick and tangible economic results, whereas maintenance requires the slower development of supporting institutions and benefits are apparent only in later years. But endemic road deterioration can quickly create a crisis in the...
The economic effects of neglecting maintenance will always be borne by the road users in the form of increased vehicle operating costs, since a poor road is 20-40% more costly to transport goods than a good road. In the lifetime of a road, the accumulated vehicle operating costs can amount to from 3 to 10 times the construction cost of the road itself. In the end, therefore, reducing expenditure on road maintenance will not serve the intended purpose of freeing resources for other activities. Instead, road users, mostly in the private sector and a high proportion of whom require foreign exchange for spare parts, tires and replacement vehicles, pay these costs. A comparison of costs for preventive maintenance and rehabilitation shows that when maintenance is neglected and rehabilitation becomes necessary, the cost per km increases from 2.5 to 8 times the cost of regular maintenance. Therefore, by failing to redirect public spending to maintenance and constructing new roads, some African countries have been found to lose 3 to 4 kms of potentially good roads for every km of new roads they construct.

Road transport prices in Africa are on average 2.5 to 3 times higher than in other regions of the world. (Incidentally, construction costs in Africa are markedly higher than elsewhere.) Available statistics reveal that transport costs are more than 15% of the prices of several African export commodities. The land-locked countries pay additional transit charges amounting to about 20% of the value of goods transported, making many commodities less competitive in global markets. In the end who pays the burden of high transport costs? Mainly the already impoverished farmers in the countries’ interior.

Arresting the deterioration process and repairing damage already suffered will require serious government commitment and coordinated efforts by the international donor community. Changes in policy and improvements in institutions and management, good choices of technical options and, in some cases, an increase in the amounts and reliability of financial inputs to the road sector will be necessary. In other cases the length of maintained road networks may have to be reduced in order to direct available resources to road links with the highest social and economic priority.

The Road Maintenance Initiative

An agenda for action has emerged from the experiences of governments, proceedings of conferences, and from the experience of international lending agencies and bilateral donors. ECA has discussed road maintenance on a number of occasions during the last few years, and at the Fourth African Highway Maintenance Conference in Harare (December 1987). One of the specific suggestions made at that conference was that the road deterioration problem be presented to the African Transport Ministers Conference in Kinshasa this Spring to obtain their endorsement of efforts made under the SSATP. The ECA and the Bank together did this, and the draft resolution below was unanimously approved.

- Review of budgetary mechanisms including earmarking and creation of road funds to reallocate funds for road maintenance and rehabilitation.
- Institutional strengthening of road agencies.
- Training and motivational initiatives to improve institutional performance and reduce staff turnover.
- Reliance on locally available resources including appropriate and more labor-based technologies.

Objectives

The World Bank, in collaboration with the ECA and several bilateral donors, has designed the SSATP Road Maintenance Initiative for African policymakers and senior managers to:

- increase their awareness of, and reach common assessment on, the magnitude of the road maintenance problem, and to increase their motivation and commitment to address the problem by changing attitudes and behaviors;
- identify appropriate technical, financial, and organizational policy options, and develop policy action plans for specific road agencies and institutions; and
- support and monitor the implementation of national policy reform plans, and assess the effectiveness of the plans carried out.

Through these initiatives it should also be possible to establish or strengthen regional institutions to assist countries in road maintenance policymaking and planning. At the same time, the action-oriented Road Maintenance Initiative will improve cooperation and coordination among international lending institutions and bilateral aid donors.

Issues to be Addressed

Addressing policy improvement and institutional reform is undoubtedly a priority. The following concerns are
considered important to finding effective, long-term solutions and taking the appropriate steps to resolve the road maintenance and deterioration problem.

**Institutional Reform of Road Agencies.** African policymakers should consider, if warranted, separating planning and supervisory functions from the execution of maintenance and construction works, and management policies to strengthen accountability of staff at all levels for the use of resources and for carrying out tasks and reaching institutional objectives. Accountability may also have to be extended from the managerial level to the political level and to road users. In countless instances political and private interests have brought pressure on road authorities to divert resources intended for road maintenance. The effect of disrupting the maintenance mission of the road authority is the same, regardless of motives. The consequences of road neglect are a matter of public interest and, as such, they need to be made known to the general public and potential interest groups to stimulate the coalition of interests necessary to influence public policy.

It is significant to note that in all cases where there has been substantial success in establishing effective road maintenance institutions there have been individuals in positions of responsibility who grasped both the importance of the maintenance function and the necessity for the efficient use of resources. Without political commitment at some level the maintenance function invariably suffers from neglect.

**Budgetary mechanisms.** Insufficient funding and delays in the release of funds remain a problem for road maintenance and rehabilitation. Reallocation of funds from new construction to rehabilitation and maintenance will be necessary in practically every country. This reallocation will not be easy given the mechanisms of the budgeting process. Nevertheless there is a need to seriously attempt such reallocations, if necessary, through the reclassification of certain maintenance expenditures as capital expenditures. This will require the commitment of finance ministries, as well as appropriate roads ministries.

Policymakers will have to consider such options as earmarked funds or road funds to ensure sufficient allocations of road user revenues for road purposes. This puts a clear focus on road expenditure and offers a basis for better planning and accountability. A systematic analysis may be required to determine how much should be spent on roads, and how. Some governments may need to revise user charges or impose new ones which, if translated into better roads, can reduce rather than increase the cost to the public.

**Technical options and economic consequences.** Severe competing demands for resources require economic design of highways and maintenance programs, taking into account not only the costs to the government, but also the much larger costs of vehicle ownership and operation borne by road users. Policymakers, particularly those with budget constraints, will have to compare the economic consequences of different maintenance options in the context of actual conditions to find the best network-level maintenance policies.

**Human resources.** There is scope for improved staff in several facets of road maintenance—from the substitution of unskilled labor for machinery to the governments’ difficulties in retaining competent managers, engineers, technicians, etc.—giving rise to the demand for more effective manpower planning, training and development programs to anticipate and meet needs. These plans should not only address the quantitative requirements of the training program, but the qualitative aspects as well, and should be based on an analysis of the kinds of skills that need to be developed.

**Local resources.** The use of labor-based methods can be more cost effective than equipment for many maintenance activities where wage rates are low. These methods are less dependent on foreign resources and for that reason are normally less susceptible to disruption. They create needed employment opportunities and increase self reliance. Simple equipment, which can be made using locally-based technologies and local materials in road pavements and structures, can also be considered.

**Local Contractors and Consultants.** Identify appropriate policy reforms to enable effective participation of local civil contractors, plant repair shops, and consultants in executing many tasks presently undertaken, or attempted, by road agencies.

**Project Description**

The Road Maintenance Initiative is envisaged as a five-year project, to be carried out in three phases.

**Phase One** consists of a series of Policy Seminars designed to bring African policymakers together to exchange experiences and views on the above issues. The Seminars are designed to:

- increase awareness, and reach a common assessment of the magnitude of the road deterioration problem;
- identify appropriate operational, financial, organizational or other policy options relevant and applicable to addressing and redressing the road deterioration problem;
- give participants the opportunity to discuss and explore the relevance and applicability of these
policy options to their own circumstances;

- obtain, where possible, the commitment of policymakers to pursue these policy options—with external technical and/or financial assistance where required and requested;

- increase participants' awareness of the support and commitment by the donor community to the pursuit of these policy options and concomitant investment programs.

The focus of the Phase 1 seminars of the RMI will be to assist a group of high-level policymakers in policy action planning so that they can discuss specific policy changes required in their countries to improve road maintenance, and let them develop during the seminar a simplified action plan comprising a set of realistic policy reforms for their countries. In addition, the seminar is designed to develop commitment and attitudes. We hope to find that high-level officials in several participating country teams have the will to change policies. Without such a person inside the government of a participating country, it will be difficult to bring about significant policy changes.

By the end of the first series of seminars we should know which of the sub-Saharan countries have realistic views of their needs for changes in policy; we would be better informed as to how committed each delegation is to reforms; and by requesting them to come back to us in writing after they have returned to their countries, we should get a true indication of their commitment.

In a Second Phase, follow-up workshops will be held for governments willing to commit themselves to policy-action plans. In preparation for these workshops, governments will prepare detailed assessments of their road maintenance situations including policies, road inventories, manpower and financial resource projections, and reviews of plans in the roads sector. Technical assistance may be provided if requested to assist with these preparatory activities, which would include:

- description and assessment of the highway organization;
- identification (diagnosis) of specific problems;
- definition of a certain number of policy reforms and prioritizing of decisions (action plans);
- implementation plans;
- cost estimates.

It is hoped that at least a few countries will volunteer for Phase 2. Only a few good demonstration projects are enough to convince others. If too many countries give positive response after the seminars, those few countries first where both the Bank and the sponsoring donor community feel there is a chance of success both in raising funds for Phase 2 and 3, and in implementing policy reforms will be given selection priority.

The detail and design of Phase 2 has not been established, since it is expected to be country specific, and therefore to be elaborated by the countries themselves. Funding for this phase of the RMI is expected to come from the aid donors, in particular from the donors that support Phase 1, and/or donors supporting the transport sector in the volunteering countries.

Through a detailed country-specific diagnosis stage of the Phase 2, the countries are expected to tailor the design of that phase and the policy action planning workshops to the needs of particular countries. Establishing inter-ministerial committees to guide this work has also been proposed for particular countries.

In a Third Phase following the establishment of the action programs, participating governments will meet to discuss their experiences with the action plans in terms of progress and problems during implementation, and remedial steps identified as necessary.

Phase 3 could include both implementation of the policy reform and activation of a physical program of rehabilitation and preventive maintenance (rescaling and regravelling) of roads. Coordinated external support for restoring the road networks would be handled by the operational divisions of development agencies including the World Bank. The SSATP would marshall support for region-wide mobilization of resources needed for the restoration program, and focus on the implementation of policy reform programs. The SSATP would continue to provide opportunities for country interactions to assess progress and compare experiences in implementing the program. Through the transport data component the SSATP will also be able to follow up the introduction of new policies and provide some information about changes in efficiency and performance within the sub-sector of a particular country.

**Phase One, Policy Seminars**

The Economic Development Institute of the World Bank is assisting the program in the design, preparation and presentation of the series of six seminars.

**Participants.** A series of six Seminars will be designed for, and delivered to, all countries in Sub-Saharan Africa. Each government will be invited to send a team of officials from relevant ministries related to the planning, financing, budgeting and implementation of road maintenance and rehabilitation programs. Because
the Seminars are aimed at exploring policy options and bringing about policy changes, dialogue will be conducted with ministers and top civil servants who work at the level of government where substantive policy reforms would be initiated. Accordingly, the country teams would be led by the Minister responsible for the central roads department, normally the Minister of Public Works or Transport, depending on the organizational arrangements for each particular country. He would be accompanied by the Chief Engineer (Roads) or Roads Director responsible also for maintenance and rehabilitation programs. The country teams would include senior officials of the Ministry of Planning and the Ministry of Finance and would be directly responsible for programming and budgeting road expenditures. Country teams will consist of three or four officials, depending on the country. Their specific composition will be discussed and agreed with the relevant World Bank Country Department prior to sending out the invitations to the prospective participants.

For practical and logistical reasons and to minimize costs the series will be run in two groups—the first, consisting of three anglophone seminars, and the second, three francophone seminars.

Content and Format. Each seminar will address three major topics. These have been divided into themes for the preparation of background papers with relevant case studies:

A. **Planning, Financing and Management** for road maintenance and rehabilitation programs, specifically
   - Planning, Programming and Budgeting,
   - Physical Planning and Management, and
   - Financing and Pricing Mobilization.

B. **Operations and Management** of road maintenance and rehabilitation activities, specifically
   - Equipment Management,
   - Appropriate Use of Available Resources and Technology, and
   - Use of Local Contractors and Consultants.

C. **Institutional Reform and Human Resource Development** in relation to road maintenance and rehabilitation, specifically
   - Institutional Development, and
   - Human Resource Development and Management

Each Seminar will begin with a presentation of an introductory paper to describe the state of road maintenance and rehabilitation in the region, and to highlight key issues and requirements to combat the road deterioration problem in physical and financial terms. Then topics A-C will be presented and discussed. This will serve to identify the major policy issues and problems related to road maintenance and rehabilitation. The objective of the first part of the seminars will be to create positive awareness of the issues and problems, and to change attitudes and build commitments towards policy changes to address the issues and problems.

The second part of the Seminars will introduce and present instruments and approaches to policy action planning and give the individual country teams an opportunity to explore and apply policy action planning instruments and approaches to their particular situation and circumstances. Each team may present a report to the closing plenary session.

In addition to the participants, moderators, presenters, discussion leaders, resource people and Seminar organizers will attend each Seminar.

**Collaborating Institutions.** As the associated agency of the SSATP with the World Bank, the ECA Transport, Communications, and Tourism Division will participate in all seminars. In addition, the Seminars will benefit from collaboration by a number of agencies that fall generally under three headings: aid donors; technical assistance institutions and African regional and sub-regional organizations. By involving a number of regional and subregional organizations in various roles and capacities one will try to achieve two additional objectives:

- an institutional development objective through the exposure to, and participation in, the seminar presentations and discussions on this matter of critical importance to Africa; and
- to obtain, for the benefit of the participants of the seminar, the value of the knowledge and experience of these organizations in the area of policies and their impact on road deterioration.

A coordinating group of representatives of BMZ, ILO, NORAD, ODA, SDC, SIDA, and the SSATP/EDI meets as required (about once every 6 months) to review and discuss the Road Maintenance Initiative.

**Preparation.** Preparatory efforts for the Seminars—a survey, papers and case studies, action planning guidelines, and country reviews—are in progress and are described below.

Survey of the road maintenance and road deterioration situation in each country, and the preparation of an introductory paper. In 1987 and early 1988, questionnaires were sent to all countries in the region to gather information on road maintenance activities in each
country including data on the present condition of the road system, maintenance costs, physical accomplishments, availability and use of resources. A compilation of the returns was the basis for a study on the state of road maintenance and rehabilitation in Africa, and has been used to prepare a policy paper on Road Deterioration in Sub-Saharan Africa, which will be used for an introductory presentation at the seminars. The survey data will also be used to update the 1982 statistics on which the “Road Deterioration in Developing Countries, Causes and Remedies” paper was based.

Preparation of Policy Issues Papers that address the specific Seminar topics focusing on policies, policy options, policy actions and policy action planning. Emphasis will be given to ongoing policies and their contribution to the current state of affairs on the road systems and to optional alternative policies and their prospective roles in ameliorating the road deterioration problem. Case Studies will illustrate actual African examples of situations where a policy action planning process has been adopted and implemented, preferably successfully. Each case study will be closely coordinated with the writing of the policy paper and together they will constitute an important part of the presentations leading to discussions on how to tackle problems through policy change.

Formulation of Policy Action Planning Guidelines including examples, will be prepared to help participants in the process of developing action plans for policy, institutional and other reforms and changes. The guidelines will highlight the effect of social and political concerns and pressures on maintenance policies.

Before arriving at the seminar each country team will prepare a Country Review and Analysis for their use and benefit in considering the relevance and applicability of policy options to be presented and reviewed at the seminars. The review and analysis will be in the form of a questionnaire, and will cover the statutory and administrative processes, procedures and constraints, including the various institutions and agencies involved and their respective roles, relating to the formulation, analysis, approval and implementation of policy changes in the areas described under the three main topics as these relate to the issues of road maintenance and rehabilitation.

Endnote:

A Policy Foundation for Better Roads*

Introduction

A well maintained road network is of paramount importance to the development of Sub-Saharan Africa. Practically 90% of land commerce is dependent on roads. African governments and their external partners have recognized the importance of good roads and have devoted substantial resources to improving road networks over the last 30 years.

Significant achievements have been made in expanding road networks across the continent. But, building the infrastructure of institutions and trained manpower to maintain them has proven difficult. Ineffective maintenance has led to widespread and accelerating road deterioration—amplified in recent years because the large number of roads built in the 1960s and 1970s have reached the end of their useful lives and need to be rehabilitated or reconstructed.

The road maintenance and rehabilitation problem has been exacerbated—as are almost all the region’s problems—by the current economic difficulties in Sub-Saharan Africa. Roads, however, are so much an engine of growth that making economically justified expenditures to ensure their continued serviceability deserves priority attention in government spending.

There has been a growing realization that road building and road maintenance are not in balance. Policies that favored construction over maintenance clearly have to be changed in favor of approaches that focus on road expenditures as a whole within a policy framework that enhances transport availability at minimum overall social cost—to government road agencies, and, more importantly, to the road users.

The first issue to be addressed in this Seminar is a national commitment to maintain a serviceable roads system. A critical requirement is a broader financing and budgeting perspective that sees road building, maintenance, and rehabilitation as a unified process with a multi-year perspective. This perspective recognizes road users as an important constituency who would rather pay fair charges to use good roads than the much higher vehicle operation and time costs resulting from roads in poor condition. It is a perspective that recognizes it is not enough to allocate funds for roads; that a real commitment includes a dependable flow of funds to allow departments of roads to effectively plan and implement their programs.

The second issue is accountability. In the absence of public pressure and lacking a clear understanding of the seriousness of the problem, few governments have given road maintenance a high priority in their budgets. The urgency of the situation has not always been fully appreciated by all donors and lending agencies, some having been readier to provide funds for new construction than for maintenance and restoration. New construction has sharp political visibility, maintenance little glamour. Inadequate maintenance in developing countries has various causes, but institutional weakness is at the heart of the maintenance problem.

The goals of roads departments must be set in terms of tangible physical performance. Planning, programming, and budgeting should focus on improving roads in terms of precisely defined and rigorously monitored physical conditions. This can only be achieved if an information system is in place that informs planners of both the state of the roads system and the results of previous maintenance outlays.

Accountability should also be turned outward towards the road users who are most immediately and directly affected by road conditions. It is the users, rather than road maintenance organizations themselves who, bear the immediate costs of poor roads. There is a vast public constituency in Africa for good roads; it should be encouraged to operate as a monitor of national road systems and an advocate of their improvement.

The third major issue is the need to adapt, improve, and reform institutions so they have both the mechanisms and the necessary incentives to increase their efficiency. The staff and managers of those institutions will need new skills to carry out these tasks; development of human resources must go hand-in-hand with the development of sector institutions.

The problem of institutional efficiency applies to all countries of the region. There is little point in increasing funds if they are not used efficiently. Planning for road maintenance, which includes budget estimation and preparation, can be strengthened by Maintenance Management systems like the ones in use in Malawi, Niger and Zimbabwe (and more recently, in

* This paper was prepared by the RMI unit in Africa Technical Department to be used as basis for the World Bank Presentation at the seminars.
Kenya). These three issues serve as the backdrop to our discussions at this Seminar.

The Economic Background

Road conditions in Sub-Saharan Africa cannot be isolated from the general economic situation in the region. Sub-Saharan Africa is confronted with slow economic growth, declining agricultural production and a heavy burden of external debt. In most countries GDP and income per capita have been stagnating or declining for more than a decade, while population growth has continued at a rate that adds 20 million people each year. The net flow of capital to the region declined from about US$14.0 billion in 1981 to US$3.5 billion in 1985. Total external indebtedness now exceeds US$100 billion and debt service, even after rescheduling, consumes about 30% of export earnings. Per capita investment in real terms declined by half from 1980 to 1987 while imports, in constant dollars, fell by 35%.

As a result, the average African is poorer today than he was in 1970. This is clearly unacceptable and hard policy choices must be made by African governments to reverse the trend. Fortunately, an important and unprecedented intellectual and economic revolution is taking place in Africa. It began slowly in the early 1980s with a handful of countries undertaking economic reform programs aimed at increasing productivity and stimulating growth. Today, more than half of the region’s countries—from tiny market-oriented countries such as Togo, Mauritius and the Gambia, to large, initially more socialist-oriented Ghana, Guinea and Tanzania—have embarked on these programs. The programs deal comprehensively with public sector management, public finance and parastatal reform. They include the introduction of realistic exchange rates and improved incentives for agricultural production, as well as adjustment in trade regimes and promotion of exports. One of the main objectives of these reforms is to create a better environment for enterprise development, unleashing the enormous entrepreneurial energies of the people. The ultimate aim of these reforms is the resumption of growth, sustainable growth with equity.

The progress being made reflects the determination the African countries themselves expressed at a 1986 special session of the United Nations General Assembly, when they declared that “Africa has taken the main responsibility for its own development .... African countries are determined to take, individually and collectively, all measures and policy reforms that are necessary for the recovery of their economies and the revitalization of genuine development.”

The transport sector—particularly roads—is key to unleashing the potential for increased production and incomes in Sub-Saharan Africa. There are telling examples where transport bottlenecks have put the brakes on growth, especially in agricultural production. The objectives for transportation can be captured in two words: efficiency (and thus lower cost) and sustainability. Poor economic performance has meant that levels of gross investment and maintenance expenditures in many countries have not been sufficient to preserve and modernize infrastructure and equipment. Institutional structures and national economic and sectoral policies have not been responsive to changing market demands or have not adequately supported the build-up of sufficient technical and managerial capabilities.

Nowhere are these policy initiatives more needed than in the roads sector. If farmers and manufacturers are to take advantage of reforms in agriculture and other productive sectors they must have a dependable road system. Without efficient transport—and in Sub-Saharan Africa transport means, more than anything else, roads—there can be no supply response to support renewed growth.

The State of Sub-Saharan Africa’s Roads

An assessment of road conditions based on limited data available for 41 countries shows that nearly one-quarter of paved roads are in poor condition and a further quarter in fair condition. The situation is even more serious for unpaved main roads where nearly 40% of roads are in poor condition and an additional 33% in fair condition.

A regional breakdown is shown on the next page. Some roads can be saved if quick action is taken; otherwise, they will either be lost, or will have to be rebuilt. The indications are that in spite of great efforts made by governments and donors over the past five years, it has only been possible to barely stabilize the situation.

To appreciate why endemic road deterioration can quickly create a transport crisis, we shall briefly examine its physical evolution and its financial implications.

Deterioration of paved roads is gradual and hardly perceptible during the initial phase after construction, lasting from 10 to 15 years, sometimes up to two-thirds of the pavement life-cycle. Even this seeming “grace period” can be drastically shortened when traffic volumes and axle loads exceed the designed capacity of pavements. Thereafter, deterioration can be swift. Routine and preventive maintenance based on careful monitoring of traffic loads and pavement conditions can
protect and prolong the life of important national investments in roads.

A comparison of costs for preventive maintenance and rehabilitation illustrates the point. Routine maintenance can be done for a cost of US$300 to US$1,500 per kilometer per year and periodic maintenance every 3 to 12 years for about US$25,000. When maintenance is neglected the eventual cost of rehabilitation or restoration is about US$30,000 per km for unpaved roads and US$200,000 per km for paved roads. This represents a 2.5 to 8 fold increase in expenditures. Also, by failing to redirect spending to maintenance, 3 to 4 km of potentially good roads are lost for every km of new construction.

The economic consequences of neglecting maintenance are primarily borne by road users—in the form of increased vehicle operating costs. A dollar reduction in road maintenance expenditures can result in an increase of US$2 to US$3 in vehicle operating costs and vice versa. In reality then, reducing expenditures on road maintenance will not serve the intended purpose of releasing resources for higher priority sectors. Instead road users, who are mostly in the private sector, bear the burden of increased transport costs, and a high portion of these costs require foreign exchange for spare parts, tires and vehicle replacement.

The governments of the region could save some US$1.2 billion in road expenditures a year (about 0.85% of regional GNP) through preventive maintenance, of which perhaps US$900 million is foreign exchange. Another US$1.2 billion would accrue to road users through reduced wear and tear on vehicles as a result of improved road conditions. These figures do not account for the costs imposed on agriculture and industry by increased transport costs, lengthened travel times, or the delayed pace of development. Road maintenance in its broadest sense includes repair and rehabilitation to restore bad roads to good condition, as well as strengthening and rejuvenation to keep sound roads in good state.

Balancing maintenance requirements against the construction of new roads is a difficult task. Decision-making should be rationalized by viewing new construction and maintenance as part of a single process aimed at minimizing total transport costs in the sector. This requires unifying road budgets so all alternatives can be ranked against each other in formulating road programs. National transport ministries and donors alike must come to recognize that most major maintenance tasks are designed to protect and extend capital investments; they belong, therefore, in the same budget category as the initial outlay for construction.

Based on their records of road condition, and on past experience of their performance, countries in Sub-Saharan Africa can be placed in four groups.

**Group 1: Botswana, Cote d'Ivoire, Djibouti, Malawi, Niger, Zimbabwe**

These countries have demonstrated a substantial commitment to road maintenance, and have the ability to implement their road programs as well as raise or attract adequate resources for the highway sector. These countries should have little difficulty in restoring—or preserving—their roads in good condition, in some
cases, as soon as 1995. They have already shown their ability and willingness to put sufficient resources into road maintenance; continuation of the same policies, sometimes with additional external funding, will be needed.

Group 2: Benin, Burundi, Central African Republic, Ethiopia, Lesotho, Mali, Madagascar, Mauritius, Rwanda, Swaziland, Togo

These countries have shown a growing commitment to road maintenance but have yet to build up adequate capacity to implement road maintenance programs. Efforts to improve maintenance look promising, and sufficient resources to undertake the needed maintenance could probably be obtained if spending priorities were adjusted accordingly. These countries should be able to restore their roads to good condition by the end of the century if they can strengthen their commitment to improve maintenance even though considerable technical and financial assistance will be needed in some cases.

Group 3: Cameroon, Gabon, Kenya, Nigeria, Senegal

These countries paid insufficient attention to road maintenance in the past, despite having the capacity and financial resources to contain the deterioration of their roads. These countries have the capacity to restore their roads by the year 2000, and could increase the funds required, but they will not achieve that target unless there is a significant change in the priority accorded to road maintenance; and

Group 4: Burkina Faso, Chad, Equatorial Guinea, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mauritania, Mozambique, Sierra Leone, Somalia, Sudan, Tanzania, Uganda, Zaire, Zambia

These countries have experienced severe problems in building up institutional capacity and attracting funds for road maintenance. Some of their networks are severely deteriorated, and a substantial amount of rehabilitation will be required. These countries will probably not be able to restore their networks to good condition by the year 2000 due to their economic climate and the size of the backlog of maintenance and rehabilitation. They will have to take difficult decisions concerning priorities of rehabilitation and maintenance that will best serve their short- and medium-term needs, including concentration of maintenance efforts on a core road network.

A review of what Sub-Saharan Africa has been spending on roads recently shows that some 60% (Groups 1, 2 and 3) have been spending about 1% of their GNP, at least over short periods, which is enough to restore and fully maintain all their essential roads. Desirable as new roads are to help development, they simply add to the road maintenance burden, which is already difficult to bear.

In the 60% of countries which have shown they can raise enough funds to restore and maintain their essential roads, a redirection of efforts away from new works to increase maintenance will be essential to avoid road failures on a large scale. For the remaining 40% of countries (Group 4), even stopping all new works until the year 2000 would still require higher levels of road financing than they have previously had. Whether these countries can plan for and manage larger amounts—and whether the donors are prepared to provide extra aid—will depend very much on the organization and efficiency of administrations in charge of roads. If they cannot create the necessary level of institutional efficiency to manage their entire road network, and if there is no prospect to provide the necessary resources, the only solution seems to be to restrict regular maintenance to a core road network that can be managed and funded within the resources likely to be available.

The Road Maintenance Initiative

The main agenda of this Seminar is to review possible actions to improve maintenance in the face of funding and organizational constraints. A repetition of past trends will result in poorly serviceable road networks with all the attendant costs and constraints on economic development. To restore the entire network would be beyond the ability of most countries, and may not always be the best use of resources, given the needs in other sectors.

By supporting this seminar, donors have shown their commitment to road maintenance. For their part, governments also need to show their commitment to the ideal of better road maintenance by setting in motion policy changes that are essential, and even by agreeing to implement these policy initiatives. It would be desirable if representatives attending the Seminar:

- agree to put in place within the next five years the policy and institutional changes necessary for improved maintenance, in particular to revise the allocation of funds in favor of maintenance and rehabilitation;
- plan for restoration of the essential road network to good condition by the year 2000.

The maintenance and restoration of Sub-Saharan Africa’s essential road networks would cost about US$1.15 billion a year over the next twelve years. This is a large amount of money, but it offers potential national annual savings of twice that magnitude; thus for every dollar spent on maintenance, governments would save one
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dollar by avoiding reconstruction costs, and road users would save another dollar in reduced wear and tear on their vehicles. In addition, by carrying out this program of restoration, most of the essential network would be in serviceable condition by the year 2000, whereas if current trends continue, most of it will have to be rebuilt at high cost. While this process is complex, difficult, and requires high levels of commitment and cooperation, it can be done!

**Agenda for the Seminar**

The main policy concerns to be discussed at this Seminar fall into three broad categories: funding, planning and programming; operation and management; and institutional reform and human resource development.

**Funding, Planning and Programming**

The reason most often given for low standards of road maintenance is that there is a lack of funds, but this is only true for about half the Sub-Saharan African countries. In the others, past expenditures on road maintenance and construction could have adequately financed maintenance and road rehabilitation. In some countries, although budgeted funds are adequate, they are not released promptly. As a result, work is interrupted, sometimes for several months. This is one reason why budget allocations are underspent although the need and means for incurring expenditure may both exist.

This topic deals with ways in which financial resources can be mobilized and put to use in the most effective manner so that scarce funds are used where they are most needed and can do the most good. The question to be addressed in this topic is: “What system of funding, planning and programming is most likely to bring about improvements in the road network?”

As we consider this question, three key concerns arise:

- developing a unified framework for planning and programming public road expenditures over the entire network, whether recurrent, capital, or aid financed;
- funding and budgeting procedures that ensure that funds are available when required, and that they respond to changing circumstances; and,
- planning and programming methods that foster accountability, in particular by programming maintenance based on road conditions and measurable physical outputs.

**Operations and Management**

Effective and efficient management of operations is crucial to addressing Sub-Saharan Africa’s road deterioration problem. More effective management that produces demonstrable improvements in both the condition of roads and the efficient use of resources is also a key to creating the political commitment necessary to increase attention to—and funding for—maintenance. It can also be a powerful tool for saving money, particularly foreign exchange.

Most road maintenance operations in Sub-Saharan Africa are run by large establishments operating by force account with geographically widespread operations that rely heavily on equipment. Maintenance operations planning and execution often overlap, and information systems are not adequate for management to track the quantity and quality of performance or assess and prioritize needs. Maintenance managers have also been overburdened by the need to keep up huge—and often incompatible—equipment fleets and supervise large and far-flung work forces. Improving information flows and streamlining management tasks are perhaps the two key factors in improving management efficiency.

The key recommendations are:

- to increase accountability by improving information and management systems so maintenance managers can effectively plan and track performance, and, in addition, separate planning and monitoring functions from works execution;
- to adapt the size of the mechanical equipment fleet to reflect maintenance needs and increase the efficiency of equipment use;
- to spin off management burdens through increased use of contractors; and
- to adopt appropriate technology and using local resources for self-reliance and sustainability.

**Institutional Reform and Human Resources Development**

Institutional and human resources development has been one of the most difficult areas in terms of making permanent improvements. It has been difficult to establish self-sustaining institutions that can manage road maintenance efficiently or use external resources effectively. Institutional problems with road maintenance arise because of the inherent managerial complexity, and the geographical dispersion of maintenance operations that require a territorial
organization. Institutional progress has been slow long-standing despite training and institutional development.

Road maintenance has been only one of many claimants on the region's overstressed education and training facilities. Specialized personnel remain in woefully short supply. It is generally agreed that a minimum of about 30 graduate level engineers and scientists per 10,000 people are needed to service a modern economy. In most Sub-Saharan African countries, the proportion is less than a third of this number.

There are many issues here, but they may be summed up under two main headings:

- institutional reform to increase the efficiency of road maintenance and rehabilitation; and

- better management of human resources through motivation, adequate incentives, and efforts to develop a stronger and more competent workforce.

Conclusion

This seminar has been arranged as a forum where the long-standing and serious problem of inadequate road maintenance in Sub-Saharan Africa can be discussed, important policy decisions taken, and future actions agreed on. The principal issues have been examined and reviewed in a number of technical papers to act as a background for our discussions. After the work groups have done their work and decided on relevant policy concerns, important decisions will need to be made concerning the key issues discussed here—or others that you may deem important. While it is recognized that external support will be needed to help achieve many of the actions expected to result from these seminars, it is the national governments that must make the vital policy decisions to support action plans aimed at:

- restoring of the essential road network by the end of the century; and

- implementing the necessary institutional reforms and procedural changes within five years.

The donors can only do so much. Without a long-term commitment by governments to the necessary reforms, real progress is unlikely. Our schedule here calls for two days of plenary and work group discussions on the three major topics of the meeting, and a third day in which each country team will prepare action plans for implementing these concepts to support their own national road maintenance and rehabilitation efforts. These efforts should serve as a good beginning towards the goals of improving road maintenance and road conditions throughout Sub-Saharan Africa.
Introduction and Summary

Road networks across Sub-Saharan Africa have deteriorated to the point that the resources and skills to repair and maintain them are simply not available. Instead, regional countries face a range of second-best choices. They must choose which roads to rehabilitate, and which to maintain—and at what level. They must make difficult and often mutually exclusive trade-offs between constructing new roads and preserving existing investments.

The donor community, which is at least partially complicit in the creation of the present situation, has an obligation to support national administrations in making and carrying out these choices. Setting a cooperative agenda to consolidate and begin improving the region’s key transport facility—its road network—will be a difficult and challenging process.

The roots of the roads problem are historical. In the immediate post-colonial era road building was given far higher priority than institution building—and road maintenance was given even less attention. New national roads administrations woefully short of trained personnel and managers were given road-building and maintenance portfolios that would have daunted much stronger institutions. Their assignment was rightly seen as one of the most important for rapid economic development: creating the transport links that would tie new nations together in economic and political unity.

Foreign donors recognized the priority of transport and provided large amounts of assistance to create new roads. They spent much less effort on helping to create the institutional and financial systems needed to protect these investments. The result was a burden of road maintenance that increased much more quickly than national abilities to bear it.

Two accidents of timing have amplified this problem. The pace of road building peaked in the early 1960s and 1970s, creating thousands of kilometers of highways that are now reaching the end of their design life at the same time. The downturn in regional economic growth has meant that this increased need for road rehabilitation and replacement has coincided with a stringent reduction in the financial resources needed for the task.

Now the choices are difficult. It is clear that attention must be turned strongly away from road-building and toward the re-establishment and protection of the existing capital base. But even that task is large—and requires a significant level of political, financial, and institutional commitment that will be difficult to muster and sustain. In many cases it will be beyond immediate national capabilities and resources, and the slow process of building those capabilities will require a painful process of adjustment, in effect a short- to medium-term reduction in national road mileage.

Here are the facts, based upon a study of the data available for 41 regional countries:

- Neglected maintenance has left half of Sub-Saharan Africa’s paved roads in only poor to fair condition. More than 70% of the unpaved roads are in the same situation. Many of these roads are in imminent danger of being lost as usable thoroughfares. Some can be saved if quick action is taken. Delays will mean that more and more of them will have to be either abandoned or completely rebuilt at costs that can range well above US$200,000 per kilometer.

- Financial resources desperately needed for maintenance continue to be channeled, instead, into new construction. Data from 23 countries show them spending an annual average of 1.1% of GNP on roads. This would have been roughly enough to maintain national roads already in good condition and restore a sizeable portion of those whose condition has fallen to fair—but had not almost 60% of these funds been spent instead on building new roads.

- Despite these figures, money is not the key issue. A number of extremely poor countries with few resources to devote to the roads sector have much better records in maintaining their existing road stock than countries with much higher per capita and national incomes. In part, this reflects relatively smaller road networks. The main factor, however,
seems to be their realization of the economic importance of preserving existing assets, and a firm political commitment to maintenance that includes a willingness to forego often prestigious new road projects.

- Fundamental systemic changes—often starting at the highest political levels—are needed to stem the rapid wasting away and disappearance of the region’s road assets. Attitudes, institutions, and mechanisms will all have to be changed. The process will be difficult, costly, and slow. Donor agencies will have to change their approaches as well. They must be both more realistic and committed to more consistent and longer term efforts. They must show more cooperation and coordination, and less rivalry. They must be more supportive, more sensitive to African approaches and realities, and less prescriptive.

Even given all of the above, the choices are not attractive. Limitations on resources and absorptive capacities severely limit how much can be done, and how quickly. The changes that are needed will, in themselves, divert time and energies from road work itself.

The World Bank has considered four scenarios for assessing the road maintenance and rehabilitation problem in Sub-Saharan Africa:

1. Limit efforts to routine maintenance of priority roads. This would cost an estimated US$228 million a year, and raise the proportion of paved roads in poor condition in the year 2000 to 78% in East Africa and 91% in West Africa. No unpaved roads would remain in good condition. (see Glossary for definition). The situation is even more serious for unpaved roads where about 39% of roads are in poor condition and an additional 32% in fair condition. This is clearly not an acceptable scenario.

2. Fully maintain those roads now in good condition and apply minimum maintenance standards to the remainder of the network. This would cost US$409 million a year. By the year 2000, this would bring 50% of the East African—and 46% of West African road networks to at least fair condition. This would cost $409 million a year.

3. Fully maintaining good roads and restoring failing roads. This would cost US$680 million a year through the year 2000.

4. Restore the entire network to good condition by the year 2000. This would cost an estimated US$1.8 billion a year, and is clearly an unaffordable scenario.

Each country must choose its own path to adequate road maintenance, based on its priorities, the extent of its problems, and its available resources. In most cases this will involve making a difficult initial choice as to which roads are economically worthy of maintenance and rehabilitation—a process of triage that recognizes that the only practical choices for many countries may be to maintain and retain only a core network of essential roads.

Applying this standard across the region suggests that its network of economic roads could be maintained, including necessary rehabilitation, for approximately US$1.15 billion a year. This represents 0.8% of regional GNP, an amount not at all inconsistent—if the imbalance between maintenance and new building is redressed—with present estimated expenditures of US$1.54 billion a year (1.1% of GNP).

It should be borne in mind, however, what such a choice entails. The proportion of roads resources devoted to new construction will have to be greatly reduced, usually to 20% or less of total expenditures. A significant number of roads will have to be put on an absolutely minimal maintenance regime, or abandoned entirely. Institutional changes, many of them difficult and some requiring significant investment, will have to be undertaken. Basic decisions on such issues as the relative roles of the public and private sectors and the uses of labor and equipment intensive methods will have to be taken.

**Condition of Road Networks**

An assessment has been made of current road conditions in SSA countries based on data available for 41 countries.1 Nearly one-quarter of paved roads are in poor condition and a further quarter in fair condition (see Glossary for definition). The situation is even more serious for unpaved roads where about 39% of roads are in poor condition and an additional 32% in fair condition. Table 1 gives a regional breakdown and compares the 1988 data with that for 1984 (shown in parentheses). Road conditions have been defined according to the extent of maintenance and repair work that needs to be carried out to restore roads to good condition. The remedial actions required are usually a function of both road condition and traffic. However, in Sub-Saharan Africa, only a small percentage of the main road networks have an AADT of more than 500 vehicles per day, so that linking remedial action and costs directly to road conditions implies less error than would be the case on more heavily trafficked networks in the region in other regions. Paved roads in fair condition are assumed to require resurfacing and selective repairs while those in poor condition are assumed to require reconstruction.

Given the unreliability of the data, it cannot be said that the changes indicated are significant. In West Africa, there seems not to have been any deterioration.
or improvement in the average road conditions between 1984 and 1988. In East Africa, there appears to have been a real improvement in the condition of paved roads. Some countries have reported extensive changes in road conditions over the past four years. While this may be credible for small networks, several of the improvements reported in the larger networks imply an amount of maintenance and rehabilitation within four years that has not actually occurred. This highlights a major difficulty in assessing road conditions in that results are very subjective unless a fully developed road management system is in place. Several countries have begun the process and others have had inventories on road conditions carried out by consultants. Consequently, the 1988 data may be based on more reliable data for a few more countries than the 1984 survey data. The problems with the condition studies highlight the need for systematic road condition inventories in all countries so as to allow monitoring of the effectiveness of road maintenance programs and the subsequent accountability of road maintenance agencies.

As in the 1984 survey, road conditions vary widely between countries, with the proportions of good, fair and poor respectively ranging from 94%, 4% and 2% as reported for one country, to 0%, 10% and 90% in another (See Table 2 for data on individual countries). Nearly 30% of countries have less than one-third of their paved road networks in good condition, indicating the extent to which maintenance has been neglected. The situation with respect to unpaved roads is even worse; about 80% of countries have less than one-third of the networks in good condition.

<table>
<thead>
<tr>
<th>ROAD CONDITIONS IN SUB-SAHARAN AFRICA (1984)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good</td>
</tr>
<tr>
<td>%</td>
</tr>
<tr>
<td>------</td>
</tr>
<tr>
<td><strong>East Africa</strong></td>
</tr>
<tr>
<td>Paved Roads</td>
</tr>
<tr>
<td>Unpaved Roads</td>
</tr>
<tr>
<td><strong>West Africa</strong></td>
</tr>
<tr>
<td>Paved Roads</td>
</tr>
<tr>
<td>Unpaved Roads</td>
</tr>
<tr>
<td><strong>All Sub-Saharan Africa</strong></td>
</tr>
<tr>
<td>Paved Roads</td>
</tr>
<tr>
<td>Unpaved Roads</td>
</tr>
</tbody>
</table>

*Road Deterioration Study. Weighted averages according to length of network have been used throughout.*
Melody Mason & Sydney Thriscutt: Road Deterioration in Sub-Saharan Africa

either resealed, strengthened or reconstructed each year paved roads and 6.5% for unpaved roads. Only six carried out on road networks in the 16 countries unpaved roads received either periodic maintenance or The West and Central African survey carried out in insufficient work was carried to prevent further Past

### TABLE 2 ROAD NETWORKS BY COUNTRY

<table>
<thead>
<tr>
<th>Country</th>
<th>Network 1987 (km)</th>
<th>Paved Condition of Roads</th>
<th>Unpaved Condition of Roads</th>
<th>Main Paved Network</th>
<th>Main Unpaved Network</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>GNP (US$m.)</td>
<td>Length (%)</td>
<td>Length (%)</td>
<td>Good (%)</td>
<td>Fair (%)</td>
</tr>
<tr>
<td></td>
<td>GNP per capita 1980-87</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Eastern and Southern Africa**

<table>
<thead>
<tr>
<th>Country</th>
<th>Network 1987 (km)</th>
<th>Paved Condition of Roads</th>
<th>Unpaved Condition of Roads</th>
<th>Main Paved Network</th>
<th>Main Unpaved Network</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>GNP (US$m.)</td>
<td>Length (%)</td>
<td>Length (%)</td>
<td>Good (%)</td>
<td>Fair (%)</td>
</tr>
<tr>
<td></td>
<td>GNP per capita 1980-87</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Western Africa**

<table>
<thead>
<tr>
<th>Country</th>
<th>Network 1987 (km)</th>
<th>Paved Condition of Roads</th>
<th>Unpaved Condition of Roads</th>
<th>Main Paved Network</th>
<th>Main Unpaved Network</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>GNP (US$m.)</td>
<td>Length (%)</td>
<td>Length (%)</td>
<td>Good (%)</td>
<td>Fair (%)</td>
</tr>
<tr>
<td></td>
<td>GNP per capita 1980-87</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Past Maintenance Performance

Implications for Future Road Conditions

The West and Central African survey carried out in 1981-82 found that very little maintenance activity was carried out on road networks in the 16 countries included in the study. Only 4% of paved roads were either resealed, strengthened or reconstructed each year and 3% of gravel roads were regraveled or rehabilitated. The findings of the 1988 study indicate that the level of activity has increased slightly—for a similar number of countries about 5% of the paved and 6% of the unpaved networks received some kind of periodic maintenance or reconstruction in 1987-88. However, insufficient work was carried to prevent further deterioration of networks since only 3.5% of paved and unpaved roads received either periodic maintenance or strengthening compared to the required 5.5% for the paved roads and 6.5% for unpaved roads. Only six countries out of 18 carried out work on more than 5% of their paved and unpaved network. Consequently, if
the above findings for 18 countries are indicative of what is happening in the remaining Sub-Saharan Africa countries, road networks will deteriorate even further unless the present level of maintenance is increased.

Based on this assumption, the percent of paved roads in good condition would decline from 50% to 38% by the year 2000, and the percent of roads in poor condition would increase from 23% to 40%. However, these figures represent the average for the whole region; the repercussions of continuing low levels of maintenance for some countries will be far worse. For example, six countries did not carry out any resealing between 1984 and 1988, which means that for these countries, there would be very few roads in good condition by the year 2000 at present maintenance levels. This situation is perhaps not as serious as it appears for some lower income countries where reconstruction or high levels of maintenance would not be justified on many of the deteriorated roads because of low traffic levels. Nevertheless, even after excluding low volume roads the study data indicates that over half of the countries surveyed are still not carrying out sufficient levels of maintenance to prevent further deterioration, even on high economic priority roads.

Adequacy of Maintenance Funds

Chronic shortage of funds allocated to road maintenance is the most usual reason given for the poor condition of road networks. However, analysis of the resources devoted to road construction, road improvement and road maintenance reveal that, in spite of best intentions frequently expressed, some countries have been spending funds on new roads while maintenance has been inadequate. Data for 23 countries indicate that an average of just over 1.1% of GNP (excluding Cameroon with nearly 3% of GNP) has been spent on all roads (main and feeder) in the last year or two, as can be seen in Table 3. The same percentage was found in the 1984 Road Deterioration Policy Study. On average, (based on data for 19 countries) it is estimated that 58% of roads expenditure was devoted to new construction or improvement, 25% to routine and periodic maintenance, and the remaining 17% to reconstruction or rehabilitation. The situation is similar to that found in the West and Central Africa survey where an average of 66% was spent on new construction, 20% on maintenance and 13% on rehabilitation and reconstruction for 1981-82. With road networks in the condition they are in the region, an appropriate division of roads expenditure overall given the limitation of resources, would be about 20% of the total for routine maintenance, up to 45% for periodic maintenance, 15% for rehabilitation, and no more than 20% for new work and improvement.

Obviously, the economic balance of resources between maintenance and new construction varies from one country to another. For example, both Cote d'Ivoire and Botswana have spent a high proportion of their road budgets on new construction, but the level of maintenance has been quite adequate. The problem is with those countries that have spent more than 50% of their road budgets (including aid) on new construction while maintenance of the roads currently in good to fair condition has not been adequate and/or roads in poor condition have not been rehabilitated or resurfaced (see Box "Nigeria's New Roads and the Risk of Massive Deterioration"). It is estimated that 50% of countries for which sufficient information is available (28 countries) fall in this category.²

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**Nigeria's New Roads and the Risk of Massive Deterioration**

About 60% of the Nigerian paved Federal Trunk Road System (23,000 km) was rebuilt between 1975 and 1985. Over that time, there was a very large economic expansion following the 1973-74 rise in oil prices, and traffic flow increases of between 15% and 35% annually were not uncommon on the main road network. Despite the expansion and improvement of the Nigerian paved road system at a cost of about US$8 billion, and its apparently satisfactory condition (67% Good, 5% Fair and 28% Poor in 1988), the situation is still precarious. The design standards used encouraged generous geometric features but weak pavements, so that substantial strengthening is required within a few years to avoid rapid deterioration. The costs of this would be about US$150-200 million a year, plus generally improved maintenance. With the fall in oil revenues, it will be difficult to find this amount of money, and if there are no funds, the trunk road system may deteriorate rapidly, requiring massive rehabilitation and reconstruction work within the next five to ten years.
### TABLE 3
EXPENDITURES ON HIGHWAYS (average 1986-88, in 1988 prices)

<table>
<thead>
<tr>
<th>Country</th>
<th>GNP per capita 1980-87 (US$)</th>
<th>GNP (1988 prices)</th>
<th>Current Expenditures</th>
<th>Capital Expenditures</th>
<th>Total Expenditures (US$ m.)</th>
<th>Total Expenditure as % of GNP</th>
<th>Total Maintenance Expenditure as % of GNP</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>EASTERN AND SOUTHERN AFRICA</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ETHIOPIA</td>
<td>120</td>
<td>5,537</td>
<td>15,450</td>
<td>2,565</td>
<td>18,015</td>
<td>40,000</td>
<td>63,750</td>
</tr>
<tr>
<td>MADZAMBIQUE</td>
<td>150</td>
<td>2,135</td>
<td>10,500</td>
<td>1,600</td>
<td>12,100</td>
<td>25,500</td>
<td>40,600</td>
</tr>
<tr>
<td>MARA</td>
<td>150</td>
<td>3,125</td>
<td>8,000</td>
<td>1,200</td>
<td>9,200</td>
<td>17,000</td>
<td>26,200</td>
</tr>
<tr>
<td>MADAGASCAR</td>
<td>200</td>
<td>4,196</td>
<td>4,196</td>
<td>1,200</td>
<td>5,396</td>
<td>10,500</td>
<td>16,800</td>
</tr>
<tr>
<td>TANZANIA</td>
<td>230</td>
<td>7,296</td>
<td>7,296</td>
<td>2,000</td>
<td>9,296</td>
<td>16,200</td>
<td>25,500</td>
</tr>
<tr>
<td>EGYPT</td>
<td>300</td>
<td>10,000</td>
<td>10,000</td>
<td>2,000</td>
<td>12,000</td>
<td>22,000</td>
<td>34,000</td>
</tr>
<tr>
<td>SUDAN</td>
<td>330</td>
<td>12,000</td>
<td>12,000</td>
<td>2,000</td>
<td>14,000</td>
<td>26,000</td>
<td>40,000</td>
</tr>
<tr>
<td>LIBERIA</td>
<td>360</td>
<td>15,000</td>
<td>15,000</td>
<td>2,000</td>
<td>17,000</td>
<td>32,000</td>
<td>50,000</td>
</tr>
<tr>
<td><strong>WESTERN AFRICA</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHAD</td>
<td>100</td>
<td>1,000</td>
<td>1,000</td>
<td>200</td>
<td>1,200</td>
<td>2,200</td>
<td>3,400</td>
</tr>
<tr>
<td>GUINEA-BISSAU</td>
<td>170</td>
<td>3,000</td>
<td>3,000</td>
<td>500</td>
<td>3,500</td>
<td>6,500</td>
<td>10,000</td>
</tr>
<tr>
<td>EQUAT. GUINEA</td>
<td>180</td>
<td>5,000</td>
<td>5,000</td>
<td>1,000</td>
<td>6,000</td>
<td>11,000</td>
<td>17,000</td>
</tr>
<tr>
<td>MALI</td>
<td>250</td>
<td>8,000</td>
<td>8,000</td>
<td>1,600</td>
<td>9,600</td>
<td>17,600</td>
<td>27,200</td>
</tr>
<tr>
<td>THE GAMBIA</td>
<td>280</td>
<td>10,000</td>
<td>10,000</td>
<td>2,000</td>
<td>12,000</td>
<td>22,000</td>
<td>34,000</td>
</tr>
<tr>
<td>NIGER</td>
<td>310</td>
<td>12,000</td>
<td>12,000</td>
<td>2,000</td>
<td>14,000</td>
<td>26,000</td>
<td>40,000</td>
</tr>
<tr>
<td>BURKINA FASO</td>
<td>340</td>
<td>14,000</td>
<td>14,000</td>
<td>2,000</td>
<td>16,000</td>
<td>30,000</td>
<td>46,000</td>
</tr>
<tr>
<td>S.M.</td>
<td>360</td>
<td>16,000</td>
<td>16,000</td>
<td>2,000</td>
<td>18,000</td>
<td>34,000</td>
<td>54,000</td>
</tr>
<tr>
<td>DJIBOUTI</td>
<td>390</td>
<td>18,000</td>
<td>18,000</td>
<td>2,000</td>
<td>20,000</td>
<td>38,000</td>
<td>58,000</td>
</tr>
<tr>
<td>COMOROS</td>
<td>410</td>
<td>20,000</td>
<td>20,000</td>
<td>2,000</td>
<td>22,000</td>
<td>42,000</td>
<td>64,000</td>
</tr>
<tr>
<td>TIMBENNE</td>
<td>430</td>
<td>22,000</td>
<td>22,000</td>
<td>2,000</td>
<td>24,000</td>
<td>46,000</td>
<td>68,000</td>
</tr>
<tr>
<td>SWAZILAND</td>
<td>470</td>
<td>24,000</td>
<td>24,000</td>
<td>2,000</td>
<td>26,000</td>
<td>50,000</td>
<td>76,000</td>
</tr>
<tr>
<td>MAURITIUS</td>
<td>500</td>
<td>26,000</td>
<td>26,000</td>
<td>2,000</td>
<td>28,000</td>
<td>54,000</td>
<td>82,000</td>
</tr>
<tr>
<td><strong>Estimated Total Road Expenditures in Sub-Saharan Africa:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>US$15.4 billion (1.1% of GNP)</td>
</tr>
</tbody>
</table>

Only 20% of countries have spent more than 50% of total road budgets on new construction and have still managed to carry out a reasonable level of maintenance. For more than two-thirds of the countries, expenditures on periodic resurfacing (surface dressing/seal coats) have been too low. These concerns were raised at the Donors’ Meeting for Roads Aid in Africa, held in London in 1985. 

**Staffing**

Comparison with the present pattern of road expenditure could lead one to think that routine maintenance is receiving about the correct proportion of funds. This is not necessarily true. One of the major problems affecting the cost of road maintenance is the large and often unproductive labor forces attached to roads organizations that are basically not labor intensive. This has come about because road maintenance is used as a means of reducing rural underemployment and introducing cash into subsistence economies. It is not unusual to find that two-thirds or more of the road maintenance allocation is spent on wages for labor, which is both redundant and permanent. While one cannot disagree with the objective of improving the lot of the rural poor, at the same time it must be realized that a roads authority run primarily as a social welfare organization
cannot be expected to follow the precepts of sound technical management (see box "Overstaffing in Kenya").

Of the 17 countries for which some data was available on the number of road maintenance staff and their cost, six are spending more than half of their force account maintenance expenditures on staff, including three which spend more than two-thirds. This proportion would be high even for a fully labor-intensive organization, which these are not. The average percentage of expenditure on staff is about 45% which compares with 30% found in the 1981-82 survey of West and Central Africa, although the two figures are not strictly comparable because the countries are not the same in the two studies. On average, maintenance staff maintain 3 km of road per person, which is quite low considering that labor-intensive methods are not used extensively in the region. Excessive staffing is a major problem in some countries, including Kenya, Burundi, Sierra Leone, and The Gambia.

**Overstaffing in Kenya**

In Kenya, funds for road maintenance have consistently been below requirements. The squeeze on road funding was made worse by apparently unconnected developments: the increase in the government's permanent establishment, and the District Focus policy.

Until 1982, the roads department had employed about 1,000 permanent staff and some 9,500 casual labor. Wages for this number amounted to about 39% of the total recurrent budget (KL 6.7 million out of KL 17.3 million). After other payments, about KL 9.7 million was available for works, which was already inadequate.

Three years later, the number of established posts in the roads department had increased from 1,000 to 14,600. Casual labor had been placed on the permanent establishment, and as part of the District Focus, other ministry personnel at the local level had been brought into the roads department. More than 94% of this staff came under District control, and 55% of the roads department's budget was handed over to the Districts, who spent more than 90% of this on wages, leaving very little for work. As a result, funds for work controlled by the roads department headquarters were reduced to KL 6.3 million by 1986, about two thirds of the inadequate amount they had three years earlier.

In a move to capture funds for trunk road maintenance, a toll road scheme was introduced with revenue from tolls earmarked for the periodic maintenance improvement of trunk roads. After some initial problems, a modest, but reliable, source of funds for the roads department, which are not subject to unexpected reductions, was provided.

**Bank Experience**

The World Bank's experience shows that there seems to have been some progress in road maintenance operations in just over half of the Sub-Saharan Africa countries where there has been Bank support for the roads subsector for 15 years or more. Nevertheless, considerable effort has to be made to develop maintenance organizations to the point where they can manage their road networks competently; most will require technical assistance for at least the next five to ten years. Unfortunately, little progress has been made with road maintenance in the other half of the Sub-Saharan Africa countries where the Bank has been operational. This finding is supported by a study of maintenance components of 16 completed projects financed by the World Bank, showing that nine projects were not successful in meeting their objectives and that only one project was completely successful. Nearly all projects suffered from either a lack of local funds or problems with the timely release of funds.
Apart from the lack of funds, the main problem areas are the lack of qualified and experienced engineers and technical and supervisory personnel, poor maintenance of equipment fleets, lengthy procurement procedures, weak or inefficient administrative and organizational structures, diversion of maintenance resources to other activities, low salary levels resulting in poor motivation of staff, lack of accountability (both internal and external), and poor planning and monitoring of maintenance activities.

Previous attempts to determine whether there are any lessons that can be drawn from the experience of countries where maintenance has shown improvement suggest that the only common factor is real commitment and support for road maintenance at the highest levels of government. The key to effective maintenance capacity is to convince those at the highest political and technical levels of the benefits of road maintenance and to institutionalize such commitment so that progress made with developing maintenance agencies is not lost with the removal of key people. An encouraging fact is the large number of countries expressing interest in road maintenance and reconstruction and are either implementing, or are in the process of preparing, intensive maintenance programs. The Bank expects a far higher rate of success than in the past given the large quantum of resources devoted to preparation of such programs and the large amount of maintenance and rehabilitation works to be undertaken by contract. Nevertheless, if such programs are to be successfully implemented they require intensive monitoring of project activities by the maintenance agencies themselves, with support from external donors. All too often the necessary resources are not available to do this, which considerably diminishes the impact of contract maintenance activities.

Contract Maintenance

In the past, maintenance activities were mostly carried out by force account, but many of these activities could be carried out by contract, external or local, depending on local contracting capacity. In view of the failure of repeated attempts to develop force account operations, many countries are now turning to contract maintenance and trying to develop local contracting capabilities. Routine maintenance can either be contracted out by adapting the lengthman system, that is, by assigning up to five kilometers of road to those residing alongside it (as in Kenya, Rwanda and Ghana) or contracting out tasks to local community groups (Gambia). The experience so far is not sufficient to draw conclusions about the effectiveness of contract maintenance, although experience in some countries, such as Kenya, is encouraging. Contract maintenance is certainly not a panacea for all problems. A review of maintenance activities in Sub-Saharan Africa has shown that resealing has been carried out by contract in many countries for some time, but there is no apparent correlation between resealing by contract and the adequacy or the volume of resealing carried out. Nevertheless, given the general failure of force account to operate efficiently in Sub-Saharan Africa, contract maintenance, with intensive efforts to make it effective, may provide the best hope to achieve maintenance targets for many countries.

There have been two major reasons why contract maintenance has sometimes failed. The first is the lack of local counterpart funds and the second is procurement procedures that present obstacles, and are sometimes insurmountable, at every stage of the tendering process. The first problem goes hand-in-hand with commitment to maintenance and careful planning of financing sources during the preparation stage of maintenance projects. The second problem has evolved because procurement procedures have developed in an ad hoc manner, with regulations dating back to colonial times mixed in with a labyrinth of new regulations designed to prevent abuses of the tendering system. The result is that the tendering process takes an inordinately long time and that all decision-making is centralized, hence maintenance engineers at the field level have no authority to let or change contracts. There needs to be a complete overhaul and rationalization of procurement systems to adapt them to the requirements of road maintenance if contract maintenance is to succeed.

Kenya is one example of a country that has undertaken considerable maintenance work by contract. It had tried to develop regraveling and rescaling force account units for many years but productivity remained low partly because of the lack of funds allocated for inputs other than labor, difficulties in procuring inputs such as bitumen, and the low level of equipment availability. The move to contracting started more than 15 years ago when local regraveling contractors were developed and today they carry out most of the regraveling activities. More recently, rescaling operations have been carried out by contract with considerable success, and probably at no higher cost than force account operations, taking into account all the hidden costs. Unfortunately, Kenya has been unable to maximize all the benefits of contract maintenance since it has not reduced its labor force. The result has been that labor accounts for 70% of maintenance force account expenditures, and can often not be utilized because of lack of equipment and other essential inputs.

GNP and Adequacy of Maintenance

The tenuous connection between the wealth of a country (in terms of per capita GNP) and the condition of its roads expressed as a proportion of the paved network in good condition, is shown in Figure 1.
Although there is a slight upward trend in road condition with increasing per capita GNP, there are obviously many other factors in play apart from the mere availability of funds. If Sub-Saharan Africa countries are placed in four groups, according to whether they are above or below the mean road condition line, and according to whether they have a GNP per capita of more or less than US$500 a year, we can see the comparatively good maintenance performance of some low-income countries (in terms of the percent of their paved roads in good condition) compared with some of the high-income countries. Excluding those countries where the network is still relatively new (Burundi and Nigeria), Niger and Malawi stand out as low-income countries that have managed to keep a relatively high percent of their paved roads in good condition. Madagascar also has an above average percent of roads in good condition because of the great strides it has made recently in restoring its network after allowing it to deteriorate for many years. On the other hand, some countries with double or more the income of the above countries have well below the average percent of roads in good condition (Senegal, Swaziland, Cameroon and Gabon), mainly because emphasis has been put on new construction at the expense of road maintenance. In some cases, low expenditure on the roads subsector as a whole can be explained by extreme priority given to some other sector.

The success of some low-income countries in maintaining their road networks demonstrates that low income need not be an insurmountable obstacle to maintaining roads. This is not to deny that such countries may have more difficulties because of the lack of local funds and other resources, such as skilled manpower. But if governments are truly committed to developing road maintenance capacity, even funding and other resource problems can be eventually overcome because of the high motivation of those involved.

**Road Maintenance Requirements**

The 1984 Road Deterioration Policy Study found that for the high priority network in Sub-Saharan Africa, US$5.0 billion was required to restore the backlog of paved and unpaved roads in poor condition to an adequate standard, and an additional US$0.7 billion a
year over the period 1986-90 to stabilize the current situation, i.e., to ensure that roads in good and fair condition would not deteriorate further. Using exactly the same methodology but updated data on road condition and unit costs, the amount required in 1988 for restoration of roads in poor condition is approximately the same as in 1984 but a higher amount, US$1.2 billion, is required to stabilize the remainder of the network, mainly because of higher unit costs.

Maintenance Strategies

An estimate has also been made of the cost of fully restoring the high priority road network to satisfactory condition by the year 2000. This would involve the reconstruction of roads in poor condition, strengthening and the resurfacing of paved roads, the rehabilitation of unpaved roads in fair condition and routine and periodic maintenance of all roads in good condition. The estimated cost only refers to the existing road network and it is assumed that new roads built between 1989-2000 will not significantly affect maintenance requirements. Given the financial and implementation problems that may affect the rate at which maintenance programs can be carried out in different countries, four different maintenance strategies have been considered, based on economic priorities. Assuming there are no large variations in traffic, preventive maintenance (including periodic resurfacing and strengthening) generally has a higher economic return than reconstruction, mainly because of the cost savings from not having to reconstruct deteriorated roads at a later date. Therefore, if there are insufficient resources to maintain and restore all economically viable roads, emphasis should be put on the preventive maintenance of roads currently in good or fair condition. Obviously, this would not apply in all cases, but given that it is not possible to estimate a strategy for each country, the following four strategies present a generalized approach, assuming the level of traffic generally found in Sub-Saharan Africa:

1. Base Case: Routine and Emergency Maintenance

This corresponds to what would probably take place in a number of countries if there were no change in government policies and very little aid for maintenance. Roads would be maintained at current low levels or significantly reduced levels. Labor forces for routine maintenance would stay in place, and activities would continue on a largely unplanned basis and in response to obvious failure as and when it occurs, in order to keep traffic moving on major routes.

2. Roads now in Good condition are maintained correctly

Since by proper attention, those paved roads now in good condition can be kept in that state with periodic resurfacing at about one-twelfth the cost of rebuilding a failed road in poor condition (US$210,000/km), it appears to make economic sense where resources are limited to preserve the maximum length of good roads rather than tackle those that have already deteriorated, provided such a strategy is justified by the level of traffic on the road. In practice, it is not easy to adhere to this strategy, since public and political pressure is always to restore the obviously failed roads, rather than preserve those that still appear to be in usable condition.

3. Maintain Good Roads and Restore those in Fair Condition

If more resources are available than required for Strategy (2), the next stage is to prevent roads in fair condition from deteriorating by strengthening and repairing them at an estimated cost of US$93,000/km, rather than allowing them to fail, so that the per km cost to restore them is doubled. This strategy leaves the backlog of failed roads untouched, and again there will be pressure to restore these.

4. Restore the network to Good Condition

This strategy involves preservation of the good roads, resurfacing of fair roads, and rehabilitation of the poor roads over a number of years. In view of the time required to plan a program of this nature, it is considered unrealistic to expect that an elimination of the entire Sub-Saharan Africa road restoration backlog could be accomplished before the year 2000.

Maintenance Requirements and Cost Estimates

Costs have been estimated for the four strategies for the high priority road network (the basis for the cost estimates is given in Annex 2). Not all of the classified main road networks in poor condition in Sub-Saharan Africa will be economically justified for rehabilitation, due to low traffic volumes. In the past, the construction or upgrading of some roads in Africa was either not based on any economic evaluation or was based on optimistic assumptions about traffic growth that have not materialized. Consequently, efforts in several countries are now concentrated on the upkeep of an "essential priority network", with the tacit implication that roads outside this network are to be minimally maintained or abandoned, at least for the present, because it is not economic to restore them. Countries currently implementing this strategy include Ghana, Uganda, Chad, Congo, Zaire, Madagascar and Guinea. Other countries which will have to concentrate resources on a reduced, high priority network because of low traffic volumes (or limited implementation capacity) include Tanzania, Senegal, Burkina Faso, Mozambique, Zambia, Sudan and Liberia.
To take account of the fact that it will not be economic for all classified roads to be restored to good condition, the full program of preventive maintenance and rehabilitation for the whole classified network has been reduced according to GNP per capita, following the methods outlined in Annex 2. It has been necessary to use such a formula because of the lack of data on costs and traffic, and hence the economic viability of roads for many countries. The application of a GNP formula reduces the network to be maintained by about 25% for paved roads (although it has been assumed that all paved roads will receive routine maintenance) and 50% for unpaved roads. Use of the GNP per capita model to eliminate uneconomic roads reduces the estimated cost of the maintenance program for Sub-Saharan Africa by more than one-third, but for the lower income countries the cost is reduced by as much as 80%. Although the use of such a formula may not give an accurate picture of what is actually required for each country, it does give an indication of the aggregate amount of expenditure required for priority networks for Sub-Saharan Africa as a whole. Programs required for low-income countries tend to be underestimated while those for high-income countries tend to be overestimated, but such disparities tend to cancel each other out.

Total costs of the four maintenance strategies, reduced to annual average expenditures over the period 1989 through 2000, are presented in Table 4A. These costs only refer to the high priority network and do not include low traffic feeder roads. However, the amount of expenditure required for the maintenance of feeder roads is comparatively small in relation to the main road network. All costs are in constant 1988 prices. The cost of restoring all economic roads to good condition by the year 2000 Strategy (4) is estimated at US$1.15 billion a year for the next twelve years. The cost in the first seven years (US$1.2 billion per year) would be slightly higher than for the last five years (US$1.05 billion per year) because of the work required to prevent roads now in fair condition from deteriorating to poor condition, which means more overlays would be carried out in the first seven years. The breakdown of total expenditure required under Strategy (4) for different maintenance activities over the period 1989-2000 is shown in Table 4B.

Road Condition

Obviously, various strategies would have different implications for the condition of high priority roads, as indicated in Table 4C. If only routine maintenance is carried out, Strategy (1), 78% of paved roads would be in poor condition in East Africa and 91% in West Africa by the year 2000, while no unpaved roads would be in good condition. By at least preventing roads now in good condition from further deterioration, Strategy (2) the percentage of paved roads in poor condition in the year 2000 would be reduced to 50% in East Africa and 46% in West Africa. Strategy (3) would stabilize the percent of roads in poor condition at current levels, and Strategy (4) would restore all economically justified roads so that none would be in poor condition by the end of the century. It should be noted that all of these figures apply only to the priority network as estimated by the GNP model. Non-priority roads, which, in most cases, would continue to receive minimal maintenance, would remain in fair or poor condition unless or until traffic or other factors warrant rehabilitation.
## TABLE 4A

**SUB-SAHARAN AFRICA: MAINTENANCE STRATEGIES AND COSTS**

(US$ million per year)

### Strategy (1). Continuation of Routine and Minimal Maintenance

<table>
<thead>
<tr>
<th>Region</th>
<th>Paved</th>
<th>Total Cost</th>
<th>Foreign Exchange</th>
</tr>
</thead>
<tbody>
<tr>
<td>East Africa</td>
<td>54</td>
<td>50</td>
<td>8</td>
</tr>
<tr>
<td>West Africa</td>
<td>57</td>
<td>67</td>
<td>9</td>
</tr>
<tr>
<td>Total</td>
<td>228</td>
<td>34</td>
<td></td>
</tr>
</tbody>
</table>

### Strategy (2). Roads now in Good Condition Correctly Maintained, plus Minimal Maintenance on Balance

<table>
<thead>
<tr>
<th>Region</th>
<th>Paved</th>
<th>Total Cost</th>
<th>Foreign Exchange</th>
</tr>
</thead>
<tbody>
<tr>
<td>East Africa</td>
<td>99</td>
<td>69</td>
<td>31</td>
</tr>
<tr>
<td>West Africa</td>
<td>144</td>
<td>97</td>
<td>53</td>
</tr>
<tr>
<td>Total</td>
<td>409</td>
<td>123</td>
<td></td>
</tr>
</tbody>
</table>

### Strategy (3). Maintain Good Condition Roads and Restore Fair Condition Roads to Good, plus Minimal Maintenance on Balance

<table>
<thead>
<tr>
<th>Region</th>
<th>Paved</th>
<th>Total Cost</th>
<th>Foreign Exchange</th>
</tr>
</thead>
<tbody>
<tr>
<td>East Africa</td>
<td>193</td>
<td>101</td>
<td>95</td>
</tr>
<tr>
<td>West Africa</td>
<td>215</td>
<td>171</td>
<td>113</td>
</tr>
<tr>
<td>Total</td>
<td>680</td>
<td>285</td>
<td></td>
</tr>
</tbody>
</table>

### Strategy (4). Restore Economically Justified Networks to Good Condition by Year 2000

<table>
<thead>
<tr>
<th>Region</th>
<th>Paved</th>
<th>Total Cost</th>
<th>Foreign Exchange</th>
</tr>
</thead>
<tbody>
<tr>
<td>East Africa</td>
<td>276</td>
<td>140</td>
<td>140</td>
</tr>
<tr>
<td>West Africa</td>
<td>470</td>
<td>261</td>
<td>251</td>
</tr>
<tr>
<td>Total</td>
<td>1147</td>
<td>514</td>
<td></td>
</tr>
</tbody>
</table>

For comparison, the estimated annual cost to restore all roads to good condition by the year 2000 is as follows in millions of US Dollars:

<table>
<thead>
<tr>
<th>Region</th>
<th>Paved</th>
<th>Unpaved</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>East Africa</td>
<td>480</td>
<td>429</td>
<td>909</td>
</tr>
<tr>
<td>West Africa</td>
<td>542</td>
<td>389</td>
<td>931</td>
</tr>
<tr>
<td>Total</td>
<td>1022</td>
<td>818</td>
<td>1840</td>
</tr>
</tbody>
</table>
TABLE 4B
TOTAL EXPENDITURE REQUIRED UNDER STRATEGY (4)
for the period 1989-2000

<table>
<thead>
<tr>
<th></th>
<th>KM</th>
<th>Expenditure (US$ million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reconstruction of paved roads</td>
<td>18,570</td>
<td>3.90</td>
</tr>
<tr>
<td>Reconstruction of unpaved roads</td>
<td>39,390</td>
<td>1.30</td>
</tr>
<tr>
<td>Strengthening/Resurfacing of paved roads</td>
<td>20,430</td>
<td>1.90</td>
</tr>
<tr>
<td>Rehabilitation of unpaved gravel roads</td>
<td>33,930</td>
<td>0.80</td>
</tr>
<tr>
<td>Resealing of paved roads</td>
<td>84,390</td>
<td>2.00</td>
</tr>
<tr>
<td>Regraveling of unpaved roads</td>
<td>107,690</td>
<td>1.40</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>304,400</strong></td>
<td><strong>11.30</strong></td>
</tr>
</tbody>
</table>

Annual requirement for routine maintenance: US$ 0.23 billion

Consequently, about 60% of the countries in Sub-Saharan Africa have demonstrated the ability to provide sufficient funds, at least for a single year, to finance the scale of expenditure called for to restore their road networks. However, although the level of funding has been on a scale approaching what would be required for correct maintenance and restoration of the network, the proportion of road funds allocated for maintenance and rehabilitation has not. The need in these countries is not so much the provision of extra funds for roads, although finding the necessary foreign exchange will be difficult, but rather to ensure that available funds are directed towards essential works and used as efficiently as possible. It would be unrealistic to expect all construction and improvement work to come to a stop, but a large reduction from previous levels is essential. It will also be necessary to move towards a more sustainable balance between routine and periodic maintenance. However, for the other 40%, even stopping all new works until the year 2000 would still call for higher levels of road financing than previously provided, which will be unrealistically high in some countries. The position is complicated by the fact that the poorer the country, the more difficult it becomes to allocate even low proportions of GNP to road maintenance with any degree of certainty.

Country Situations

Obviously, the prospects for clearing the backlog of maintenance vary from one country to another. These prospects depend on the level of commitment to maintenance, the capacity to implement maintenance programs, and the availability of funds. Based on past experience, countries can be placed into one of four categories (Table 5). Countries in the first Group have demonstrated a commitment to maintenance and have the ability to implement maintenance programs and attract adequate resources to the highway sector (from both internal and external sources) to carry out adequate maintenance, although more may be necessary in the future. Countries in the second Group have not demonstrated the same level of commitment to maintenance and have consequently not been able to build up the capacity to implement programs. Nevertheless, efforts to improve maintenance look promising and financial resources would probably be forthcoming based on current levels of external aid for the highway sector (provided they are concentrated on maintenance).

The third Group countries have neglected road maintenance despite having the capacity and financial resources to prevent excessive deterioration of their road networks. They have the necessary sources of financing, and the ability to prepare maintenance programs and to build up their maintenance capacity. If there were to be a change in commitment towards improved maintenance, it would be possible for them to restore their road networks.

Countries in the fourth Group have neglected road maintenance and have experienced severe problems in developing implementation capacity and/or attracting sufficient resources to the road sector. Some of them have allowed roads to deteriorate to the extent that it will be very difficult to clear their maintenance backlogs by the end of the century. Commitment to maintenance would have to go hand-in-hand with changes in macroeconomic conditions to make available the necessary inputs and attract the private sector to maintenance activities.
TABLE 4C
PROJECTED ROAD CONDITION

<table>
<thead>
<tr>
<th>Maintenance Strategies:</th>
<th>Condition of Roads</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Good</td>
</tr>
<tr>
<td>Present Condition</td>
<td></td>
</tr>
<tr>
<td>Paved: E. Africa</td>
<td>50</td>
</tr>
<tr>
<td>W. Africa</td>
<td>53</td>
</tr>
<tr>
<td>Unpaved: E. Africa</td>
<td>37</td>
</tr>
<tr>
<td>W. Africa</td>
<td>19</td>
</tr>
<tr>
<td>Strategy (1): Routine maintenance only</td>
<td></td>
</tr>
<tr>
<td>Paved: E. Africa</td>
<td>0</td>
</tr>
<tr>
<td>W. Africa</td>
<td>0</td>
</tr>
<tr>
<td>Unpaved: E. Africa</td>
<td>0</td>
</tr>
<tr>
<td>W. Africa</td>
<td>0</td>
</tr>
<tr>
<td>Strategy (2): Prevent roads in Good condition from deteriorating</td>
<td></td>
</tr>
<tr>
<td>Paved: E. Africa</td>
<td>50</td>
</tr>
<tr>
<td>W. Africa</td>
<td>53</td>
</tr>
<tr>
<td>Unpaved: E. Africa</td>
<td>37</td>
</tr>
<tr>
<td>W. Africa</td>
<td>19</td>
</tr>
<tr>
<td>Strategy (3): Restore roads in Fair condition and maintain Good roads</td>
<td></td>
</tr>
<tr>
<td>Paved: E. Africa</td>
<td>83</td>
</tr>
<tr>
<td>W. Africa</td>
<td>71</td>
</tr>
<tr>
<td>Unpaved: E. Africa</td>
<td>28</td>
</tr>
<tr>
<td>W. Africa</td>
<td>53</td>
</tr>
<tr>
<td>Strategy (4): Restore roads in Fair and Poor condition and maintain Good roads g/</td>
<td></td>
</tr>
<tr>
<td>Paved: E. Africa</td>
<td>85</td>
</tr>
<tr>
<td>W. Africa</td>
<td>85</td>
</tr>
<tr>
<td>Unpaved: E. Africa</td>
<td>85</td>
</tr>
<tr>
<td>W. Africa</td>
<td>85</td>
</tr>
</tbody>
</table>

g/ Although no roads are shown in Fair or Poor condition in 2000, there will always be some temporarily in those categories even in a well run network, with 10-15% either in Fair condition awaiting remedial treatment or in Poor condition awaiting improvement or upgrading.
### TABLE 5

**GROUPING OF COUNTRIES ACCORDING TO ROAD MAINTENANCE CAPACITY**

<table>
<thead>
<tr>
<th>Group 1: Countries with a demonstrated commitment to maintenance, effective institutional capacity, and mostly adequate financial resources 1/</th>
<th>Group 2: Countries with a growing commitment to maintenance, and improving implementation capacity and availability of financial resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Botswana</td>
<td>Mauritius</td>
</tr>
<tr>
<td>Djibouti</td>
<td>Madagascar</td>
</tr>
<tr>
<td>Malawi</td>
<td>Lesotho</td>
</tr>
<tr>
<td>Ivory Coast</td>
<td>Swaziland</td>
</tr>
<tr>
<td>Niger</td>
<td>Ethiopia 2/</td>
</tr>
<tr>
<td>Zimbabwe</td>
<td>Burundi</td>
</tr>
<tr>
<td></td>
<td>Rwanda</td>
</tr>
<tr>
<td></td>
<td>Mali</td>
</tr>
<tr>
<td></td>
<td>Benin</td>
</tr>
<tr>
<td></td>
<td>C.A.R.</td>
</tr>
<tr>
<td></td>
<td>Togo</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Group 3: Countries that have neglected maintenance despite adequate implementation capacity and availability of financial resources</th>
<th>Group 4: Countries that have neglected maintenance because of inadequate implementation capacity, and financial resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kenya</td>
<td>Zambia</td>
</tr>
<tr>
<td>Nigeria</td>
<td>Mozambique</td>
</tr>
<tr>
<td>Gambon</td>
<td>Zaire</td>
</tr>
<tr>
<td>Cameroon</td>
<td>Uganda</td>
</tr>
<tr>
<td>Senegal</td>
<td>Sudan</td>
</tr>
<tr>
<td></td>
<td>Somalia</td>
</tr>
<tr>
<td></td>
<td>Sierra Leone</td>
</tr>
<tr>
<td></td>
<td>Liberia</td>
</tr>
<tr>
<td></td>
<td>Ghana</td>
</tr>
<tr>
<td></td>
<td>Guinea</td>
</tr>
<tr>
<td></td>
<td>Equatorial Guinea</td>
</tr>
<tr>
<td></td>
<td>Burkina Faso</td>
</tr>
<tr>
<td></td>
<td>Gambia</td>
</tr>
<tr>
<td></td>
<td>Mauritania</td>
</tr>
<tr>
<td></td>
<td>Guinea-Bissau</td>
</tr>
<tr>
<td></td>
<td>Chad</td>
</tr>
</tbody>
</table>

---

1/ Adequate financial resources subsumes a reallocation of funds from new construction to maintenance, and the availability of funds from donors for maintenance.

2/ Ethiopia used to be in Group 1, but has recently incurred more problems with funding of maintenance and implementing maintenance program.
Taking into account the financial resources and absorptive capacity of SSA countries, about one-third of countries would probably not be able to restore their high priority network to an adequate condition by the year 2000 given current macroeconomic conditions and the size of the backlog of maintenance. Another 10% of countries have the financial and implementation capacity to clear their maintenance backlog by the end of the century but may well not achieve this because of a continuing lack of commitment to road maintenance. On the other hand, because of a commitment to road maintenance and a demonstrated capacity to implement road maintenance programs, about 20% of Sub-Saharan Africa countries should be able to restore (or in some cases maintain) their roads to good condition by 1995. The remaining countries should be able to restore their networks by 2000, albeit with considerable technical assistance for some, assuming that they can strengthen their commitment to road maintenance.

External Funding of Highway Expenditures

External funding for road projects for Sub-Saharan Africa from all sources amounted to US$6.5 billion over the period 1975 to 1986, 60% of all transportation aid from 1975 to 1986. In 1985, roads aid amounted to approximately US$800 million, 44% of which was financed by the World Bank and 56% by other donors. If recent patterns of financing continue, expenditures on externally aided road projects in Sub-Saharan Africa in immediate future years would amount to about US$1,000 million a year, involving contributions from the Bank of about US$350 million (44% of external aid) and US$450 million (56% of external aid) from other donors totalling US$800 million a year, plus US$200 million a year from local resources. If the proportion spent on new construction could be reduced to 20% of the total, US$800 million a year could be available for maintenance. To achieve this target, donors would have to reallocate funds in some countries from new construction to maintenance. This would allow roads in good condition to be kept in sound condition and roads in fair condition to be restored to good condition, Strategy (3); however, it would not permit the restoration of all roads in poor condition, Strategy (4). The local cost component of the total maintenance program amounts to about 55% of total costs, so that external assistance would need to cover not only foreign costs but over 60% of local cost.

To remove the backlog of roads now in poor condition in Sub-Saharan Africa countries by the year 2000, the estimated level of aid for roads would have to increase by about 35%, on the assumption that no uneconomic work is included and that funding for new construction is strictly limited. The local contribution of 20% would then amount to about US$270 million a year. However, these figures are averages for the whole period: if roads presently in fair condition are not to be allowed to deteriorate further more funding will be required from now to 1995, so that a 43% increase in aid would be required in the first seven years, and a 25% increase after 1995. Some countries will obviously not be able to contribute 20% of total costs, especially since eleven countries have not been able to even finance their routine maintenance activities (Guinea Bissau, Niger, The Gambia, Burkina Faso, Togo, Comoros, Somalia, Uganda, Tanzania, Mozambique and Angola). The present financial situation is such that about 80% of Sub-Saharan Africa countries will probably require external assistance for periodic resurfacing activities, as well as for strengthening and reconstruction. Nigeria, Cameroon, Gabon, Congo, Botswana, Mauritius, Côte d'Ivoire, and possibly Swaziland, should be able to finance their own routine and periodic resurfacing activities but may still require assistance with strengthening and reconstruction works.

It is unlikely that a 43% increase in aid can take place between now and 1995, especially considering the time it would take for project preparation. More importantly, it is unlikely that many countries could absorb very much more assistance, judging by their past records. A review of road maintenance programs shows that 27 countries in Sub-Saharan Africa are implementing programs (with a further 10 countries actively preparing them) but that 60% have either had, or are about to have, substantial delays. Reviews of maintenance projects generally indicate over optimism about the rate of project implementation. This means that clearance of all the backlog by the end of the century is most unlikely, and it would be unduly optimistic to expect that such an increase in aid could be absorbed. In addition, ongoing construction and improvement projects have to be completed, and any switch into 80% of total expenditures for maintenance cannot be expected within less than three years, even with the full support of governments and donors. Taking these factors into account, it seems unrealistic to expect that it will be possible to clear the backlog of roads which are economic to restore by the year 2000.

In spite of the apparently bleak situation in the region, a number of cases show that, with determination and commitment, very real improvements can be achieved in even the most unpromising circumstances. Roads in Madagascar had been neglected for years, and the 1984 survey showed that half the main paved road network had failed. There had been inadequate allocations for maintenance (although road user charges were enough to cover routine and periodic resurfacing costs), poor planning and management, a shortage of trained staff and unsatisfactory contract administration. Government decided to improve the position, and helped by the 5th and 6th World Bank-financed Highway Projects, the proportion of failed main roads dropped in five years from 50% to 16%. The current 7th Highway Project is
planned to complete paved road rehabilitation. A similar story can be told of road improvements in Ghana, although improvement has not yet progressed so far as it has in Madagascar (see box "Road Neglect and Restoration in Ghana"). Tanzania and Senegal have both shown willingness to make the necessary changes to improve road maintenance, and a large (US$1 billion) rehabilitation project is planned for Tanzania. A similar project in Senegal would use local and international contractors to restore most of the main roads to good condition. Other countries, including Ethiopia, Malawi, Niger, Zimbabwe and more recently, Kenya, use management information systems to increase the efficiency of road maintenance planning and control. When fully operational, these will indicate the most economical level of maintenance, taking account of road condition and traffic.

The average unit costs on which cost estimates are based assume that quality control, cost control and allocation of funds are all effective. To the extent that this is not the case, the amount and quality of maintenance work done will fall short of targets, and road conditions will not improve as they should. Bank reports contain frequent references to shortfalls in these three areas, and it is evident that efforts over the past two or three decades to improve institutional functions within roads authorities by use of management systems and personnel training have been slow to show any concrete results. More effective means have to be found for achieving the targets of maintenance programs probably by greater use of the private sector.

### Economic Benefits of Road Maintenance

Disregarding traffic benefits, once the decision is made that a paved road carrying significant amounts of traffic should be preserved, alternatives are either to maintain the road now or to rebuild it at some time in the future, say in the year 2000. A road now in good condition can be kept in operation by a program of rescaling or light overlay Strategy (2), and the cost to the road authority of doing this is the extra cost of rescaling, US$23,600 per km every 7 years, or US$3,400 per km per year. This has a net present cost to the roads authority of about US$21,000 per km (at 12% over 12 years). If the road is allowed to deteriorate it will require rebuilding at a later date at an average cost of US$210,000 per km which has a net present cost of about US$54,000 per km. Therefore, preventive maintenance results in a saving of US$33,000 per km. Clearly, continued

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### Road Neglect and Restoration in Ghana

In Ghana, a good road network existed before 1970, but it later suffered from serious neglect. By 1984, about 60% of the main paved roads had failed, and a further 27% were in danger of failure. Important sections of the network had become almost impassable, and access to some of the interior of the country was curtailed. Transporters refused to go there because they were afraid to damage their vehicles.

Transport costs increased in real terms by about 50% on main roads, and by more than 100% on rural roads, which were even more neglected. In some areas, the market rate for transporting fertilizer was as high as a US Dollars per ton-mile. These high transport costs cut into farm profits, particularly for poor farmers away from main roads. During the 1982-83 famine, roads in poor condition prevented the transport of food from surplus areas to areas facing starvation. High transport costs also hit the timber industry. Logs moving from the Kumasi area for export through Takoradi port were trucked over a 500 km route, because the direct route, half as long, was impassable, and rail services unreliable. This detour added US$15-20 per ton to the cost of timber.

Two World Bank projects starting in 1974 and 1975 achieved their physical targets after some delay, but had little effect on institutional improvement. A small but dedicated group of engineers in the roads headquarters were unable to increase outputs due to complete absence of motivation among most workers. Following an emergency maintenance project in 1980, a road rehabilitation and maintenance project commenced in 1985 which aimed to use the private sector in road maintenance, and to give incentives to force account workers. The project progressed quite well, with delays of about six months due to lack of local funds. This was followed by a 1988 Transport Rehabilitation Project designed to support Ghana's economic recovery program by tackling problems in road and railway maintenance and rehabilitation, transport sector institutions, and infrastructure planning.

The outlook is now considerably more hopeful. The proportion of paved roads in Good condition has more than doubled over five years (from 12% to 28%), and the proportion of failed roads has decreased. With incentives of various kinds, force account work is now more productive, while contract maintenance is firmly established.

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maintenance as proposed under Strategy (2) is in the best interests of the roads authority as being the lesser cost alternative, although this argument will be less forceful if rebuilding can be funded by "soft" foreign aid. Similar analyses for Strategies (3) and (4) show that in each case they are a less expensive alternative than allowing the network to deteriorate and then rebuilding. Similar arguments apply to unpaved roads. Governments tend to look at programs in terms of direct costs to the budget and resulting revenues but correct road maintenance affects the general public far more than it does the government. The benefits to road users, and therefore the economy as a whole, are substantial. For example, at average traffic flows and composition for the region, a paved road which has been allowed to deteriorate from good to poor condition represents an annual loss to the country of about US$5,000 per km in vehicle operating costs, mostly in foreign exchange. For unpaved roads, which carry lower average traffic flows, the loss is about US$3,000 per km per year. The order of magnitude of the total savings to be realized from lower vehicle operating costs for the reduced programs under each strategy is illustrated in Table 6.

As shown, substantial savings can be realized by maintaining roads in good condition. Strategy (3) has the highest total net economic returns of US$2.86 billion (net present value over 12 years at 12% discount rate) because of the high returns on preventive maintenance to arrest the deterioration of roads now in good and fair condition and the resulting cost of restoration in the future. Of particular importance for Sub-Saharan Africa countries are the savings in foreign exchange. For example, if roads now in good condition are allowed to deteriorate, 2.7 times more foreign exchange would have to be spent on increased vehicle operating costs and future restoration of the roads than if roads were to be resealed and regraveled in a timely manner Strategy (2).

Conclusion and Policy Recommendations

This paper has attempted to forecast the likely state of Sub-Saharan Africa’s roads at the end of the century if no extra effort is made to improve road maintenance. The forecasts are hampered by poor data, and a first essential is to improve data collection and processing for information on roads so as to allow for effective programming and monitoring of maintenance activities. With good data, reliable forecasts can be made in greater detail. But in spite of inadequate data, the general prognosis in this paper is clear: governments in Sub-Saharan Africa will face much larger outlays within a decade or so simply to keep their essential road networks in operation if they do not concentrate on road maintenance now.

Roads that are not maintained will have to be rebuilt at a much higher cost within a few years if road networks are to remain in place. There is, in addition, the undeniable but not so obvious fact that African countries use large amounts of foreign exchange every year (importing vehicles and spares) to replace vehicles that are damaged and worn out prematurely by poor road conditions. Unfortunately, it is a major problem convincing policymakers of the importance of vehicle operating cost savings to the economy as a whole since these savings do not accrue to the government budget directly, although they do represent a constant drain on foreign exchange. Only in the longer term do the benefits of road maintenance accrue directly to governments in the form of savings from not having to rehabilitate

<table>
<thead>
<tr>
<th>Maintenance Program for High Priority Network</th>
<th>Vehicle Operating Cost Savings 1/</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategy (2) over (1)</td>
<td>1,140</td>
</tr>
<tr>
<td>Strategy (3) over (1)</td>
<td>2,300</td>
</tr>
<tr>
<td>Strategy (4) over (1)</td>
<td>3,110</td>
</tr>
</tbody>
</table>

1/ Net Present Value 1988-2000, at discount rate in US$ millions
Cost Implications
of Different Maintenance Strategies
Compared to Base Case

NPV
($Million)
over 12 years
at 12%

8000

Strategy (iv) over (i):
Restore roads in Poor
and Fair condition and
prevent roads in Good
condition from deteriorating

7000

Strategy (iii) over (i):
Restore roads in Fair
condition to Good and
prevent roads in Good
condition from deteriorating

6000

Strategy (ii) over (i):
Prevent roads in Good
condition from deteriorating

5000

Total
Foreign
Exchange

4000

3000

2000

1000

0

Total
Foreign
Exchange

E
Savings in vehicle operating
costs

Cost of restoring roads to
Good condition in 2000

Increased cost of
maintenance strategy

2000

100

31
roads. In the short term, governments may appear to be making budgetary savings by reducing road maintenance allocations, but there is a net loss to the economy as a whole, due to higher road user costs.

Road maintenance is always in competition for resources with all the other activities of governments, many of them apparently more urgent, and most more obvious. While economic arguments on losses to the country in the shape of increased road user costs may convince economists, finance ministries tend to be more interested in the immediate cash situation. If by cutting back on road maintenance allocations they can appear to save money at present, they may be relatively uninterested in the threat of a larger payment at some time in the future. This is especially true if the possible future payment can be met by a donor on very easy terms. It is only when the roads engineer is in a position to demonstrate that if he does not get US$1,000 now, he will have to spend US$10,000 in the next year—and be proved correct that finance ministries will listen. Road management systems, as they are being installed in some Sub-Saharan African countries provide a means of forecasting road conditions and maintenance needs.

The single most important factor for restoration of road networks over the next decade is to obtain government commitment to road maintenance. There have been many cases where the lack of government support has meant the failure of maintenance programs, despite the availability of funds. Attempting to set up a functioning road maintenance system is unlike building a new road which is handed over in working order on project completion. In a road maintenance project it is mainly an organization and a set of patterns of behavior which are put in place, all of which can vanish within a short time if there is no potential will and commitment to support them. Hence, external aid for road maintenance cannot achieve anything permanent if the governments of the countries concerned are not convinced of the need for better road maintenance.

A study of the present state of roads shows that some countries with low GNPs and apparently difficult physical conditions have, nevertheless, managed to keep their road networks in better order than others with more funds at their disposal. In countries with a sound road maintenance record, one common factor seems to be their genuine long-term commitment to maintenance. They have been prepared to take and use advice from outside, to set up maintenance systems and keep them in place without constant changes, and to give road maintenance a high priority in budgetary allocations. Perhaps the major factor has been an interest and commitment on the part of the most senior people in government towards the preservation of their country's past investments in roads. Countries that can demonstrate, or develop, this approach usually have good prospects of restoring their road networks, with outside assistance if necessary. On the other side of the spectrum, there are those countries with histories of uneconomic investments in transport, misallocation and mismanagement of road maintenance funds, making organizational changes for changes' sake, and a tendency to view technical and economic factors as a secondary consideration, when their economies are not in a position to be able to afford this luxury. For these countries, the outlook for restoration of their road networks to good condition by the end of the century is bleak.

Governments must decide on a well planned maintenance program concentrating on the high priority network and excluding those sections of the network where high expenditures cannot be economically justified. This can mean relegating some roads to a minimal or even to a no-maintenance strategy. These measures have been taken in a number of countries, and a start made on correct planning for future maintenance, within the resources available.

It has been estimated that about US$1.15 billion is required annually to restore all priority roads to good condition by the end of the century. About two-thirds of the countries in Sub-Saharan Africa had access to sufficient funds needed for maintenance during the recent past, but the majority of these funds were spent on new construction. It will, therefore, be necessary to reduce expenditures on new construction in the future and concentrate resources on road maintenance. In the remaining one-third of the countries, maintenance funding has been severely inadequate, although some are about to receive substantial increases in external assistance. Nevertheless, even if financial resources could be made available, there is a far greater problem of absorptive capacity, especially for some of those countries with large backlogs of work. Taking such implementation problems into consideration, it has been estimated that about one-third of the countries would not be able to restore their high priority networks by the year 2000. Even for other countries the situation is by no means certain unless the commitment to maintenance radically improves. With such a commitment, it should be possible to carry out the necessary maintenance programs, provided external assistance is forthcoming, especially where countries have already prepared and/or are implementing a program of maintenance reforms.

The task of implementing effective maintenance programs should not be underestimated even where the financial resources are available and there is the necessary support from government. Experience of road projects in Sub-Saharan Africa is that whereas physical construction work is usually completed, albeit after many delays, the institution building targets to improve planning, organization and supervision of work are seldom met. Efforts to improve the efficiency of
governmental organizations have generally been hampered by such factors as lack of incentives and accountability, poor career prospects, low pay, and cumbersome bureaucratic procedures. Training, as a means to improve operational efficiency, has also not been very effective. Even if those trained remain in their positions or in government at all, they often find they are unable to apply what they have learned, because resistance to change at the higher staff levels prevents the introduction of new methods and ideas. Mechanical equipment is used inefficiently; major plant items are commonly used for only one or two hundred hours a year instead of a thousand hours or more, which makes equipment owning costs quite exorbitant.

As it has been found difficult to improve force account operations in road maintenance, there is a strong case for the use of contractors on the basic assumption that unless a well-supervised contractor is reasonably efficient, he will sooner or later go out of business, and if he does not perform as expected, he does not get paid. Although the first indications are hopeful, it is too early to say that contract maintenance will solve all problems. Where an active contracting industry does not already exist, to set one up and train contractors and employers in sound contract management is similar to the task of institution building within government organizations. However, the private sector has greater freedom to overcome the problems faced. Existing force account organizations can sometimes be transformed into successful contracting firms, with competition and the prospects of profit providing the incentive which is lacking in government organizations.

Using contract maintenance does not mean that the roads authority is at once relieved of all responsibilities. Both planning and supervision must be at a higher standard than for force account work, since the results of poor planning and supervision can easily lead to expensive claims and extra payments to the contractors—results which are less easily concealed than mistakes in force account operation. There is thus the need for reduced, but more efficient technical staff in the roads authority, who need the backing of an efficient financial administration able to process payments quickly. To monitor the operations, independent technical and financial audits need to be in place.

If contract maintenance is to be at all effective, local procurement procedures have to be improved. Maintenance requires the letting of many small contracts, which are best handled at the field level, particularly for routine maintenance activities. Procurement regulations often make it very difficult, and sometimes impossible, to handle a large number of contracts expeditiously given the time required to satisfy the restrictive regulations. It is essential that procurement procedures be streamlined and adapted to the special requirements of road maintenance.

Those operations which are to be undertaken by force account will require substantial changes in maintenance agencies. Greater incentives must be given to maintenance staff since low wages generally result in low motivation levels, and poor career prospects in complete lack of initiative. Greater efforts have to be made to balance the inputs required for maintenance so that resources, such as labor, are not left idle for lack of fuel or spare parts for equipment. More consideration has to be given to making government mechanical workshops competitive with the private sector, otherwise vehicles should be hired from, or repaired in, the private sector when government agencies cannot provide an adequate service.

To summarize, the first step is to attempt to convince the public and as many in government as possible of the wisdom of concentrating scarce resources on properly planned road maintenance, rather than new construction and improvement. Where this conviction takes hold, procedures need to be developed and installed to decide which roads are most in need of early rehabilitation, and which roads can be relegated to a minimal level of maintenance. While a suitable program is set up, the best way of executing the program must be decided, taking maximum advantage of the possibilities of contract maintenance and use of increased incentives. Resource constraints in some countries and lack of interest in others mean that it is very unlikely that more than a part of the backlog will be restored by the end of the century. While some countries will be able to restore all priority roads Strategy (4), others will have considerable difficulty in keeping their roads presently in fair or good condition in a reasonable state.

From the viewpoint of the donor agencies and their own resource constraints, it will be important that road maintenance aid be directed first to those countries that have shown commitment to better maintenance by reducing the proportion of roads expenditure spent on new works and setting up rational maintenance planning systems. The target for financing could be Strategy (4), that is, about US$1,300 million a year, including technical assistance and training in 1988 prices. It is unlikely that roads aid to Sub-Saharan Africa countries can be realigned completely into the necessary priority for maintenance in less than three years, and the scale of effort then needed would be comparable with that now envisaged for Tanzania and Ghana in their roads restoration plans. Ghana is showing some signs of slippage from the five to seven year program originally planned, and it is still too early to say what progress there will be in Tanzania. Given a real commitment on the part of Sub-Saharan Africa governments, it would be realistic to foresee foreign-aided road projects in Sub-Saharan Africa countries amounting to about US$1,300 million a year (in 1988 prices) up to the year 2005 to restore.
Melody Mason & Sydney Thriscutt: Road Deterioration in Sub-Saharan Africa

all priority roads to good condition. Since there would be heavier expenditure in the early years to save roads now in good condition from rapid deterioration, donors in Sub-Saharan Africa in general, and the World Bank in particular, should be planning for an increase of up to 50% in their expenditures on roads in Sub-Saharan Africa, with the great majority devoted to road maintenance and rehabilitation projects.

Endnotes:

1. The latest road condition data is generally for 1987 or 1988. Four countries were included in the analysis by using the last available data for 1984. Suitable data for Angola, Cape Verde, Reunion, Sao Tome & Principe and Seychelles are not available.

2. In some cases, information is only available on the overall percentage of funds spent on new construction and the general adequacy of maintenance activities whereas details of actual expenditures are either not available or there are conflicting figures.


5. To check the effect of the GNP model, comparison was made with detailed estimates for Bank projects in Ghana and Tanzania. In Ghana, a five- to seven-year program is planned to put 74% of paved roads and 64% of unpaved roads in good condition. In Tanzania, a similar program is expected to result in 70% of paved roads and about 50% of unpaved being in good condition. These compare with this paper's estimates for SSA as a whole of about 75% of paved and 50% of unpaved roads being in good condition if the whole program on the priority network is carried out.

6. In 1988, GNP of East Africa was US$56,560 million, and for West Africa, US$84,000 million, a total of US$140,560 million equivalent.

7. For 1975-84 data, see "Review of External Financing of the Transportation Sector of Sub-Saharan Africa", Bank Draft paper by Sylvie Chantal, July 1987, Table 3.3. 1985 and 1986 data are derived from OECD figures on total aid to SSA.

8. Combined Bank and IDA projects now in preparation stages total about US$1.0 billion which are assumed to be spread over the next three years (Annex 3).

To acquire data for this study, road maintenance questionnaires were sent to all Sub-Saharan Africa countries. Of 44 questionnaires, only 19 responses were received and of these, only two provide fairly comprehensive data. Indeed, a few questionnaires have data that are mostly unusable because of inaccuracies and inconsistencies. Data on maintenance unit costs and equipment are particularly scarce for all countries. In order to have more information for the study, further data collection efforts were conducted within the Bank and finally data on length of road network, road condition, and unit costs have been obtained for 38 countries, as well as, data on road expenditure for 25 countries. Remaining data on staffing, maintenance equipment and past levels of maintenance activities are fragmentary and only available for a few countries.

The Road Deterioration Policy Study results were based on a simple spreadsheet model, and the data collected for this study were used in that model to compare the situation in 1984 and 1988. Another simple spreadsheet model was developed as part of this study to estimate the expenditure requirements for different maintenance strategies up until the end of the century. (The data collected on road condition as part of the Road Deterioration Policy Study have been used for four countries where no later data are available for the purposes of estimating maintenance requirements.) A database (using Dbase) has been developed to store data for those countries that provided at least two-thirds of the information requested (about 16 countries) so that it can be used in the future for comparative purposes. However, unless the quality of the data improves substantially such a database will be of very limited use, since the information obtained is such that analysis calls for repeated subjective judgments and the use of region-wide averages because of the unreliability of individual country data, such as unit costs.
Maintenance Requirements and Cost Estimates

In estimating road maintenance requirements, the following assumptions have been made:

- that under current conditions in most Sub-Saharan countries of Africa, paved roads carrying up to 400 vpd can be kept in good condition by timely patching of locally failed areas plus rescaling. For higher traffic flows, a premix overlay would be used. Due to often inadequate quality control, the life of a rescaling is 7 years, except in a few countries where standards of work are higher (Botswana, Zimbabwe, Malawi, Swaziland, Côte d'Ivoire, and Niger) when 10 years is assumed. The average cost of rescaling used in estimates (US$23,600 per km) is for a two-lane road, and allows for a normal amount of repairs in advance of rescaling, plus the additional cost (and life) of some type of premix overlays on approximately 10% of the network where higher traffic flow warrants its use;

- that to restore a paved road in fair condition, repairs of up to 10% of the surface area will be necessary, plus a strengthening surface layer of 5 cm or more. The average cost used (US$93,000 per km) is for a two-lane road and allows for surface repairs, regulation and raising the shoulders as necessary. Without strengthening, it has been assumed that a road in fair condition will deteriorate to poor condition after seven years;

- that to rehabilitate a failed paved road in poor condition, the existing construction can be used as sub-base, but that new base and surface layers will be necessary. In the average cost (US$210,000 per km), allowance is made for some extra earthworks on shoulders and sideslopes. Mixed traffic of about 400 vpd is assumed, and a CBR 10 subgrade;

- that gravel roads consist of about 15 to 20 cm of imported natural material, and that deterioration from good to fair condition occurs in six years, with the loss of about 2 cm of surface material per year. Thereafter, if no action is taken, unpaved roads regress to poor condition in a further four years, when restoration of the formation becomes necessary. An average cost of US$13,000 per km for regraveling and US$33,000 per km for unpaved rehabilitation from poor condition has been adopted;

- that routine maintenance costs US$1,000 per km per year for both paved and unpaved roads. For paved roads, this includes normal minor repairs to the surface and shoulders, and for unpaved roads spot regraveling and up to two light gradings a year are included; and

- the distribution of high priority roads (traffic over 350-400 vpd) among good, fair and poor categories is the same as for the rest of the network. This assumption has been made in the absence of reliable data on the condition of the high priority network. The same assumption was made in the 1984 World Bank Road Deterioration Policy Study.

The costs of road maintenance operations have been estimated from country and Bank data, adjusted to 1988 levels. These display wide variations between, and even within, countries, due in part to different input costs, affected by scarcities, transport costs and high taxes. There is also the problem of defining precisely the maintenance operation. For example, some countries include shoulder grading and surface patching in routine maintenance costs for paved roads, while others do not. Mechanical equipment costs are allowed for in different ways in different countries, ranging from the cost of fuel and lubricants only, up to full commercial costing. Consequently, the following analysis has used estimated average unit costs, derived from often incomplete data in questionnaires, plus assessment of normal input requirements and costs. The unit costs used approximate reasonable contract costs, assuming effective competition exists, and that contract prices are not increased on account of such factors as non-availability of foreign exchange, distorted foreign exchange rates, inordinately high interest rates, or bad contract administration. The nature of the various maintenance operations for which costs have been estimated are defined in the Glossary, in order to clarify what is included.

In the absence of detailed traffic information, GNP per capita was used to eliminate those roads which, from an economic standpoint, probably would not warrant rehabilitation or other maintenance activities; this affects those countries with a GNP per capita below US$500 per annum. Data for Mali and Niger suggest that the proportion of a country's road network that warrants rehabilitation roughly correlates with GNP per capita. For paved roads, the relationship is 0% at zero GNP per capita and 100% at US$500 per capita. For unpaved roads, the values are 0% at US$150 per capita and 80% at US$500 per capita. Ideally, actual traffic levels should have been used to determine the economic high priority network but since even limited traffic data was not available for over half the countries, some kind of proxy had to be used.
### Road Maintenance Aid Projects Planned or Under Preparation

<table>
<thead>
<tr>
<th>Country</th>
<th>Amount &amp; Lender (US$ million)</th>
<th>Project Description</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burkina Faso</td>
<td>15.0 (IDA)</td>
<td>Road Maint. &amp; Rehabn.</td>
<td>Under Preparation</td>
</tr>
<tr>
<td>Burundi</td>
<td>19.4 (IDA)</td>
<td>Road Maint. &amp; Rehabn.</td>
<td>Under Preparation</td>
</tr>
<tr>
<td>Cameroon</td>
<td>100.0 (WB)</td>
<td>Feeder Road Maint. &amp; Rehabilitation</td>
<td>Pre-Appraisal February 1989</td>
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<tr>
<td>C.A.R.</td>
<td>10.0 (IDA)</td>
<td>Road Maint. &amp; Maint. Planning</td>
<td>Under Preparation using P.P.F.</td>
</tr>
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<td>Chad</td>
<td>46.5 (IDA)</td>
<td>Rehabn. &amp; Maint. of Tpt. Infrastructure</td>
<td>Project Appraised</td>
</tr>
<tr>
<td>Congo</td>
<td>27.0 (WB)</td>
<td>Road Rehabilitation</td>
<td>Negotiations - Jan’89</td>
</tr>
<tr>
<td>Cote d’Ivoire</td>
<td>100.0 (WB)</td>
<td>Time slice of Road Investment Program</td>
<td>Identification</td>
</tr>
<tr>
<td>Gabon</td>
<td>30.0 (WB)</td>
<td>Three-year Program of Road Maintenance</td>
<td>Appraised</td>
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<tr>
<td>Mali</td>
<td>10.0 (IDA)</td>
<td>Three-year Investment Program</td>
<td>Under Preparation</td>
</tr>
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<td>Mauritania</td>
<td>20.0 (IDA)</td>
<td>Management of Road Sector &amp; Repairs</td>
<td>Preappraised</td>
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<tr>
<td>Mozambique</td>
<td>30.0 (IDA)</td>
<td>Tpt. Rehabilitation</td>
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<td>Niger</td>
<td>35.0 (IDA)</td>
<td>Road Maint. &amp; Feeder Roads</td>
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<td>Nigeria</td>
<td>250.0 (WB)</td>
<td>Rehabn. &amp; Maint. of Federal Roads</td>
<td>Approved June ’88</td>
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<td>Nigeria</td>
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<td>Rwanda</td>
<td>33.5 (IDA)</td>
<td>Road Upgrading &amp; Maint.</td>
<td>Appraisal - Jan ’89</td>
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<td>Senegal</td>
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<td>Road Rehabn. &amp; Reconstruction</td>
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<tr>
<td>Zaire</td>
<td>105.8 (IDA)</td>
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</table>

Total: 1,060.2
Lack of financial resources is the given reason for poor road maintenance in Sub-Saharan Africa. This may be valid for about half of the region's countries; in the others, road expenditures have been at a level that could have adequately financed maintenance and road rehabilitation. Had effective planning, programming and budgeting mechanisms been in place, the prospects of adequate maintenance would have improved considerably. Topic A of this seminar examines these issues and suggests structural approaches to improve maintenance performance.

A common theme in the papers is the need for a recognition of the importance of road maintenance and a high-level political commitment to it. The region's annual losses in increased road transport costs due to a lack of attention to maintenance are estimated at US$1.2 billion; the more governments and their publics become aware of the magnitude of these losses, the more likely it is that a commitment to improve road maintenance will be made.

While there is scope for increasing funding for the roads sector from foreign assistance as well as domestic sources, improvements in the use of already available resources are a necessary first step before a credible case can be made for more money from either local taxpayers or external donors. This topic deals with ways in which financial resources can be mobilized and put to use so that scarce funds are used most effectively where they are most needed and can do the most good.

Three key issues emerge as basic to improving funding, planning and programming for more effective and efficient road maintenance:

- Developing a unified framework for planning road expenditures over the entire network, whether recurrent or capital, and whether funded by local sources or aid-financed;

- Adopting funding and budgeting procedures that assure that funds are available as and when required, and can be adapted to respond to changes in needs; and,

- Developing planning and programming methods that foster accountability, in particular, by programming on the basis of physical outputs and monitored road conditions.

These three issues and some of the options available are discussed below. They are covered more fully in the three background papers prepared under RMI Seminar Topic A: "Planning, Financing and Management."

A Unified Planning Framework

Problems

Where resources are scarce as in Sub-Saharan Africa, it becomes essential to ensure that public expenditures on roads will bring at least as great a benefit to a country as alternative uses of resources. Between sectors, quantitative comparison of benefits is not easy, and the allocation between transport and, say, health or education becomes a matter of political policy or general development strategy. It should be clear, nevertheless, that neglect of road maintenance has serious medium- and long-term consequences that can adversely affect the economic and social progress of a country.

The trade-offs between road expenditure options can, however, be quantified to enable countries to make comparisons and choices between new road construction, the restoration of failed roads, or the maintenance and preservation of serviceable roads. The goal should be to minimize total national transport costs over time. Thus the costs of investments in new construction, maintenance, and rehabilitation plus the costs in vehicle wear and tear, to users of bad roads, must all be weighed in planning a roads program.

For many countries, lack of reliable data on road conditions, traffic levels, current costs and outputs has impeded the analysis needed to compare expenditure alternatives. Without these data, planning is reduced to guesswork; scarce resources of materials, equipment and skilled labor are likely to be wasted, and credibility is unlikely to last more than a single budget cycle. Planning without facts is a hazardous venture.

Policy Options and Actions

Setting out and comparing expenditure options is the first step towards producing a credible roads program that can win the commitment of governments, transport customers, and foreign donors. This requires an assessment of all road programs—whether capital, current, locally funded, or aid-financed—under a unified programming and budgeting framework. In almost all countries such exercises will demonstrate that road maintenance and reconstruction have economic returns several times that of almost all new construction. Roads departments or national governments may wish, on occasion, to choose an investment whose long-term cost...
is higher than its alternatives. The most important thing, however, is that this choice be made consciously, in full realization of the costs it implies.

Road expenditure options cannot be competently assessed unless a management information system is regularly providing the roads authority the information needed as a basis for decision-making. Development of good management systems and data collection must proceed together. Reliable information on predictions of the future condition of the network, the costs of future rehabilitation if funds are not provided, and higher road user costs if maintenance is not done, permits the roads manager to view the roads system as a whole and formulate a defensible and balanced program of road construction, maintenance, and rehabilitation.

One of the most useful features of such systems is that if funds are insufficient to finance an adequate level of maintenance, it is possible to draw up a revised program that will limit road deterioration and user cost increases to a minimum within the funds available. At the same time, the total system costs in terms of future road rehabilitation and increased user costs can be estimated, so that the government is made aware of the consequences of underfunding maintenance.

African Experiences

In Malawi, a maintenance management system provides reliable cost and performance data for future planning. Availability of information on road conditions, traffic, and maintenance costs makes it possible to plan a maintenance program for the entire network that minimizes road failures and reduces road user costs. Zimbabwe has a similar system, and Kenya is about to put a management information system into effect. Niger has used a simple and effective system for programming periodic maintenance. Ethiopia has possibly the oldest functioning road maintenance and equipment management system in Sub-Saharan Africa.

Assuring Timely Availability of Funds

Problems

It is generally accepted that the main road network should be paid for by road users or the public as a whole. The government’s role is normally to collect revenues through road user taxes and pass them on, in whole or in part, to the roads organization responsible for providing and maintaining the network. In order for it to carry out its duties, the roads organization has to be sure of receiving those funds on an agreed schedule that takes into account cycles of road building and maintenance activities, such as rainy and dry seasons. If funds are allocated but not released on time, planned work programs are disrupted, and both efficiency and the road network suffer. If for some reason disbursements cannot be made on the agreed schedule, expenditure should be restricted according to the agreed criteria.

If taxes are insufficient to cover the costs of road construction and maintenance they must be supplemented from either general taxation or by foreign aid. If user taxes exceed total road costs, then the surplus goes to general revenue to help pay for other government activities. In many countries, road users taxes are seen as a practical means of collecting general revenue. There is nothing intrinsically wrong with this, so long as these diversions are not so large as to lead to underfunding of the roads sector or subsidies to competing modes such as railways that distort relative prices and lead to inefficiency in the transport sector.

User taxes should also be set so that, insofar as possible, different vehicle types pay according to the road damage costs they impose on the system. This prevents subsidies within the sector that could otherwise skew fleet composition toward vehicles that cause more damage than they pay for.

Options for Action

User taxes should normally be set at a level that covers at least the variable costs of road maintenance. Most countries use fuel taxes to collect the bulk of these revenues, but they should usually be supplemented with taxes more closely related to the damage different vehicles impose on roadways. These include taxes on vehicles, spare parts, and tires, as well as vehicle license and registration fees, particularly for heavier vehicles that tend to impose greater damage on roads than is recovered through fuel and vehicle taxes.

Maintaining a road network requires that resource flows be regular and reliable as well as adequate in amount. In the past the expansion of Sub-Saharan road networks, often supported by international aid, has not taken sufficient account of this. Improvements in collecting, allocating, and using funds are obvious measures, but even then regular funds for road maintenance may not be assured because of programming inefficiencies and bureaucratic red tape.

Earmarking road user taxes, such as fuel taxes and/or tolls, with payments made directly to the account of the roads organization rather than through the treasury or finance ministry, is one way of increasing dependability. Alternatively, a special roads fund may be created into which some or all road user charges/tolls are placed. Either of these mechanisms gives the roads organization some long-term assurance that funds will be readily available, so that a multi-year road rehabilitation and maintenance program can be planned, if necessary with donor cooperation, with the knowledge that funding is secure.

If sufficient resources to maintain the national road
network cannot be mobilized, a country may have only two options—each of them only a poor second best: continued deterioration of the entire road system, or a reduction of its network to a size that is affordable. To avoid deterioration of the whole network, when funding is uncertain in spite of all efforts, the best remaining choice may be to plan a “core” maintenance program that preserves essential roads in the best way possible under the given economic conditions.

African Experiences

In Kenya, as a way to finance rehabilitation of trunk roads, several main routes have been designated as Toll Routes, with the proceeds paid directly into a special fund. Earmarking of fuel taxes for a special road fund to finance road maintenance and rehabilitation has been used in several Sub-Saharan countries, including Ghana, Central African Republic and Zaire.

Raising Accountability through Programming and Budgeting

Problems

Improvements in road maintenance programming and budgeting can bring large benefits to road users and cost savings to government. One of the benefits of planning, programming and budgeting based on competent and up-to-date data is that unit costs and outputs become transparent, and there is an immediate link between the input resources (materials, equipment and labor) and physical outputs of road maintenance operations. A framework for accountability, thus, is clearly established.

Perhaps the most important aspect of this framework is that it allows planning and programming to be set on the basis of physical work outputs so that performance can be monitored. Thus, future resource needs can be forecast with greater accuracy, and areas in which efficiency increases are needed are brought to the attention of the road authorities.

In practice, however, accountability requires an appropriate institutional framework in addition to data and process requirements. In many countries the oversight and monitoring functions are carried out by institutional arms that are at the same time responsible for planning, operations, and supervision. In addition to the potential conflict of interest this structure creates, it also imposes quite specialized tasks on institutions to carry out the oversight functions. Once the idea of accountability is accepted, institutional changes will probably be required to define duties and lines of responsibility clearly, and to make monitoring of results an established function of the organization.

Options for Action

Three steps need to be taken if full accountability of the roads organization is to be established. These are the definition of quantifiable objectives based on output-based programming, setting up a suitable quality control operation, probably involving a technical audit to run in parallel with the established financial audit, and implementing institutional changes to establish an entity responsible for the audit. In addition to allowing the definition of objectives to guide agencies in their operations, output-based programming also provides a basis for monitoring and auditing performance.

Independent financial audits, operating free of ministerial control and responsible only to parliament or the president, are accepted parts of most governments. Financial audits, however, normally verify only that funds have been spent for the intended purposes as specified in the budget. There is no verification that value has been obtained for the funds expended. The concepts of productivity and quality of output are not part of the financial audit’s brief, unless the faults are glaring. A technical audit, on the other hand, is concerned that the design of works is correct, that the materials used were appropriate, and that work was done according to accepted standards. Obviously, it is convenient and desirable that financial and technical audits are integrated; a technical audit should also be free of administrative control. This means that it should have its own facilities, or at least its own independent staff who may use the roads authority’s laboratories and equipment. Although the roads organization may take the lead in setting up a technical audit, the agreement of other ministries and legislature will be needed.

For a technical audit to be effective, technical specifications are necessary, just as financial audit requires government financial regulations. It is desirable for many reasons, apart from audit, to work towards common specifications for all government work. As the roads organization is usually the most active construction ministry, it is appropriate for it to take the lead in suggesting uniform contracts and specifications.

Many road maintenance organizations combine the functions of planning and execution, and it is difficult to achieve real accountability when the same person is identifying needs, planning the program, organizing and supervising the work and reporting results to some often remote superior officer. Separation of maintenance planning and execution requires more careful planning and specification of works, which is desirable in itself. It should also result in better supervision of works and cost control.
Summary

Road users should be charged at least the short-term variable, or marginal, costs that they impose, through wear and tear or congestion on the road system. Such charges should directly reflect the costs actually attributable to the vehicles on which they are levied. Further charges may be levied on road users as contributions to the invariable costs of road administration and maintenance or to general tax revenues up to the point where the resulting distortion of the pattern of demand for road transport is compensated by significant offsetting fiscal considerations.

Difficulties in translating this theory into practice include problems of defining and then estimating short-term variable costs, particularly in economic cost terms, for different vehicle and road types; identifying the point at which significant distortions of demand occur when road user charges contribute to general tax revenues; and equating revenue charges to variable costs for different vehicle types. Actual charges can only approximate broadly a short-term marginal cost pricing structure. The paper suggests criteria for different road taxation and charging options and offers a framework for formulating an economically efficient road-user charging system.

Basic Concepts of Road Financing

The Need for Public Road Financing

Roads are normally considered collective goods or services demanded by the community, but which cannot be exchanged through market mechanisms since their use by individual consumers cannot be prevented or measured. Toll roads are an exception, but scope for these, particularly in developing countries, is limited: they require a high minimum traffic volume and substantial administrative experience to be commercially feasible, and often have considerable economic side-effects.

Road services can be regarded as a social policy goal unlikely to be provided in the desired quantities or locations by the market system. Since a free market would provide only for users able and willing to pay, the needs of isolated rural communities or low-income consumers have to be assured through alternative public services or subsidies. Even if the private sector were capable of meeting demand for road services, a government might believe that a more efficient use of the economic resources allocated to road transport could be achieved by the public/state rather than market responsibility for road investment and user charging. Finally, the private sector may be insufficiently developed or experienced to build and maintain roads, particularly in developing countries.

The Policy Objectives of Road User Charges

As an instrument of the central government, a public roads administration can be called upon, through its revenue raising functions, to contribute to broader national policy objectives beyond its narrower responsibility for the provision and maintenance of an economically efficient road system.

All governments need to raise revenues through taxation to procure goods and services that cannot be identified with specific consumers or be charged for through normal market mechanisms. In many countries, especially those with poorly developed administrative services, taxation of road users, particularly through easy to collect fuel taxes, is preferred for this purpose.

A government may also choose to intervene in activities that impose costs on society, for example, through health, safety or environmental hazards. In the transport sector it may discourage investment in obtrusive, dangerous or polluting vehicles by market correcting taxation that applies criteria conflicting with those of strict transport cost efficiency.

Taxation is also increasingly used by governments to control and manage national economies. Public works, such as new roads, may be financed with a view to reducing unemployment, resulting in investments that cannot be economically justified by normal project evaluation criteria. In this case, the objective is to influence the general level of economic activity rather
than to achieve the optimum utilization of resources allocated to roads. Thus, roads administrations may find themselves faced with potentially conflicting public financing objectives. The question to be resolved is the extent to which road taxes can contribute to these policy objectives without distorting resource allocation in the roads sector to an unacceptable degree.

The Purposes and Nature of Road Financing

Most public funds allocated to the roads sector are used to build and maintain road infrastructure. Road financing may also support subsidies to transport services in thinly populated rural areas and to certain categories of passengers or investment in police patrols, weigh bridges, or traffic management schemes to prevent dangerous driving, overloading or congestion.

Construction and maintenance, however, are likely to account for a major part of roads expenditures. While this may be accounted for in part by payments to private sector contractors, particularly for major road construction projects, it may also be directed, particularly in developing countries where local contracting industries are insufficiently experienced, to staffing and equipping the road administration's own units for construction and maintenance of roads by direct labor.

Road expenditures may originate with the central government or local authorities. A division of responsibility is often practiced, with the former financing the construction and maintenance of the major road network that carries most long-distance through-traffic, and the latter secondary roads for local traffic. Revenues for road financing can be raised locally as well as centrally, but in many cases the tax base of local authorities is inadequate for this purpose and, since locally taxed vehicles frequently operate beyond the authorities' areas of jurisdiction, it is difficult to achieve a balance between expenditures and revenues through a road user charging system. Thus, it is common for road financing and pricing to be concentrated at the center or, where roads are financed locally, for the national government to at least partially fund local authorities. But even centralized road financing cannot wholly resolve the key issue of relating road user charges to the corresponding costs of wear and tear imposed on the road system to achieve an efficient utilization of roads sector resources.

Public financing includes capital expenditure on new, or improved assets and current expenditure, on day-to-day operations or maintenance. Often there is scope for a trade-off of capital against current expenditure. It is common practice to economize on road construction standards and costs with the knowledge that this will result in higher maintenance costs. This is frequently uneconomic, merely reflecting a budget constraint, but may make economic sense if capital is scarce or if the cost of labor, normally used more intensively in maintenance than in construction, is low. Sometimes the reverse occurs and roads are built to higher than recommended standards in anticipation of maintenance neglect. Road development projects are less costly in the longer term when based on properly conceived plans for capital and current spending, rather than such short-term considerations.

The Types and Conflicting Functions of Road User Charges

It is sometimes possible for public authorities to charge directly and precisely for goods and services consumed, as in the case of water or electricity metering. Tolls provide the closest example in the roads sector, but even here charges on vehicles and the corresponding consumption of road resources through wear and tear can only be approximately equated.

Where it is not feasible or is not considered desirable to charge consumers in this way, expenditure are normally financed out of taxation. Taxes fall into several categories of which income taxes, expenditure taxes such as customs duties, wealth taxes, and poll taxes are the most important. From the viewpoint of road user charging, the most relevant tax categories are expenditure taxes on goods and services related to road transport, and poll-type taxes on road users.

Revenues from road user charges may exceed the financing requirements of roads if a contribution is to be made to general taxation or fall short, necessitating a contribution from the central treasury. In either case, the road user charging system should be structured so as to avoid excessive distorting effects on the efficient use of roads. It should be borne in mind that the object of road user charging is not merely to raise sufficient revenues to cover public roads sector spending, but also to have a "market correcting" function designed to achieve an efficient allocation of resources devoted to roads and road transport. This, too, can be a source of distortion, as when the revenue maximizing level of a tax on a particular category of vehicle is less than that necessary to recover the costs it imposes on the road network.

Road Financing and Pricing

The Economic and Sectoral Context of Road User Pricing

An appreciation of the underlying economic principles of road user charging is essential to the formulation of sound pricing policies and measures. It is difficult to analyze road financing satisfactorily in isolation from the rest of the economy; a main road improvement program might reduce public funds for schools, irrigation schemes, or other projects. If it is financed from general taxation, the charges incurred by road users may be
uneconomically low, drawing freight and passengers away from a railway obliged to recover its full costs, or causing changes in the location of industry. In this paper, it is assumed that the intersectoral effects of road financing are neutral, or have already been taken into account by the government's planning agency in its budget allocation to the roads sector.

Road construction, administration and maintenance account for the largest part of public roads expenditure, where the complexities of pricing and the scope for inefficient resource allocation are the greatest. But it should be remembered that a roads administration may incur expenditure for other purposes such as subsidization of transport, or the enforcement of safety, or environmental regulations.

The level and structure of these outlays should be such as to conflict as little as possible with the main resource allocating function of the road user charging system. Passenger subsidies, for example, should not be so great as to encourage uneconomic investment in passenger rather than freight transport or divert passengers from a lower cost rail service.

**Basic Cost Concepts**

Cost concepts are central to the whole question of road user pricing. "Costs" are, in the theoretical context, taken to mean "economic" or "opportunity" costs, defined as the value of the benefits that would be foregone by the community on withdrawing, for the purpose in question, the necessary resources from the next most desirable use. To take a simple example, if the size of a road maintenance brigade is increased by one man recruited from the land where the value of his agricultural output, now foregone, was US$2 per day, then that is the real economic cost of his labor on the roads, even if minimum wage legislation requires him to be paid US$4.

Similarly, if the brigade is equipped with an additional imported truck, then its economic cost is the value placed by the community on the alternative goods that could have been acquired with the foreign exchange used. Such costs are difficult to quantify, but it is important that the distinction between economic and financial costs should be understood.

A further distinction of importance to public enterprises, such as roads administrations responsible for major infrastructure investments, is between "fixed" and "variable" costs, meaning costs that remain constant regardless of the level of output or usage, and those that vary with it. An obvious example of a fixed (sometimes called an "overhead" or "invariable") cost is the cost of staffing and administering a roads department depot. The cost element attributable directly to wear and tear by vehicles is an instance of a variable (sometimes called a "marginal") cost, in that it would not be incurred if there were no traffic.

In all normal circumstances road users, as a whole and individually, should be charged at least the variable costs of the services they consume. If the total charges incurred by road users yield less than the costs they inflict collectively through wear and tear on the roads, demand for road use will be stimulated by an effective subsidy, and remain at an uneconomically high level with some operators making journeys they value at less than the economic costs imposed. But even if road user revenue is sufficient to cover total variable maintenance costs, it is important that charges be allocated differentially among vehicle types according to the costs they impose. If each vehicle, irrespective of type, incurred a uniform charge equal to average variable cost, heavier vehicles with above average costs, subsidized by other road users, would undertake journeys, the costs of which would exceed the benefits to the operators; there would be no incentive to substitute lighter vehicles that could reduce the road maintenance bill. In both cases, resources would be consumed wastefully in the roads sector and withheld from alternative uses where they had more value.

Even if charges are allocated among vehicles proportionately to costs, they should be levied in a manner that relates them directly to the resources consumed, which are a function of variable costs per km and distance traveled. A commercial vehicle traveling, on average, 36,000 km per year that imposes an average cost of US$2 per km on the road network should pay an annual charge of US$72,000. It would be possible (and probably convenient) for the taxing agency to collect this through an annual license fee or other standing charge. But having paid it, the operator would see no savings in restricting the number of his journeys; consequently, resources exceeding the value placed on their consumption could be used up. If the same total were raised by charges that varied directly with usage, such as fuel taxes do, a transport operator, obliged to meet the variable cost of each journey made, would not normally undertake one unless it yielded greater value to him.

No matter how efficient the method of recovering variable costs, the question remains of financing not only the invariable element of road maintenance and administration costs, but also the capital costs of new road construction. Though it is also common practice to recover these as far as possible from road users, it should be understood that this, however administratively convenient, does not necessarily contribute to the efficiency of the use of roads sector resources. If too high a proportion of the invariable costs of roads is recovered through charging measures, transport costs could increase, depressing demand and leaving a coun-
try without adequate transport services. An economically acceptable alternative would be to recover all or part of invariable road costs from the public at large, which benefits from dependable low-cost transport, through general taxation. A logical compromise from the viewpoint of roads sector efficiency is to recover fixed as well as variable costs from road users to the extent possible without causing distortions or discouraging demand. The balance could then be financed from general tax revenues (or from a specific tax on indirect beneficiaries of roads such as farmers). If all invariable costs could be recovered from road users without such distortion a further contribution to general revenues might also be feasible.

Implementation Problems of Variable Cost Pricing

In reality it cannot reasonably be expected that practice can be made to accord so closely to theory. Even leaving aside potential conflicts with other sectors or between different public financing goals within the transport sector, the underlying cost concepts themselves are, in practice, difficult if not impossible to quantify.

Economic or opportunity costs, even in countries with good statistical data, can only be crudely estimated. It is not practicable and rarely worth the effort to calculate the exact value of agricultural production that is foregone by recruiting farm labor for road maintenance work. Normally, an approximate adjusting factor is applied to financial costs, generally consistent with the estimated or observed use of resources throughout the economy: the cost of unskilled labor, for instance, might be estimated at 50% of actual wage payments.

A precise estimate of a variable or "marginal" cost depends on the time period and on the unit of output for which it is being measured. The efficiency criterion implies that shorter- rather than longer-term variable costs should be the basis for road pricing. As it is impracticable to keep changing user charges to reflect constantly changing short-term variable costs, compromise on pure marginal cost pricing is unavoidable. Practical difficulties arise in that the relative wear and tear or "aggressivity" imposed on different types of roads can only be approximately estimated.

Estimates and forecasts of traffic must be simplified into a limited number of categories. Even then the average aggressivity of each category is not known with certainty, and probably varies significantly from one operating environment to another. Several studies indicate that, for bitumen roads, aggressivity varies proportionately to the fourth power of axle weight, but this formula only applies to roughness progression on paved roads and is not applicable to gravel and earth roads. Aggressivity estimates are highly sensitive to small changes in the underlying parameters, and studies show that aggressivity, and its effects on maintenance costs, range vary widely, perhaps by as much as 500 to 1, for different vehicle types, even without allowing for overloading. Given the quality of data currently available, any system of road pricing based on variable costs can, at best, be approximate. Even if these theoretical and conceptual difficulties could be resolved, a road pricing system based on short-run variable costs would still encounter a practical problem in that the instruments available to road user charging agencies, particularly in developing countries, are too crude and imprecise to permit close links between user charges and variable costs. Even fuel taxes, which vary according to distance or road condition, correspond imperfectly to road damage inflicted by different vehicle types or suffered by different road types. Although gasoline consumption and charges incurred vary according to vehicle weight and road condition, they do so to a far lesser degree than the corresponding maintenance costs imposed.

Disadvantages of Variable Cost Pricing

In addition to these theoretical and practical problems of implementation, a variable cost-based charging system has other disadvantages that are felt beyond the road sector. If road users were to be charged only a little more than the variable costs they impose rather than whatever price they are prepared to bear, the roads administration would have no criteria for determining when roads should be built or improved. Road users and shippers would not be able to signal their demand for new facilities by raising the price they would be prepared to pay for existing limited road space or transport services. This would apply even if marginal cost pricing were in effect in other sectors of the economy. In the absence of such conventional market indicators, the allocation of national investment resources among roads and other assets, and, within the roads sector, among alternative projects, would be more difficult.

There is also the risk that marginal cost pricing, notwithstanding its theoretical advantages, may prove unacceptable in terms of social equity. If certain feeder roads serving isolated rural communities do not carry enough traffic to raise revenues sufficient to cover even variable maintenance costs, it may be considered socially desirable to subsidize road transport from other sources rather than price it out of local service.

Road Financing and Pricing in Practice

Before discussing the implementation of the economic principles it will be helpful to consider and clarify the
state's role in financing road systems. In most countries the total road system is too extensive to be administered and maintained wholly by the government. In Tanzania, for example, classified roads maintained by the State account for only 55% of the network. In some countries, roads of lesser economic or political importance—even within the classified system—are not maintained. Given this limited government capacity, the network designated for publicly financed maintenance should be related to the potential level of demand for transport services, and the country's ability to provide financial and other human resources.

The expansion of road building, often supported by international aid, during a period of relative prosperity followed by declining budgetary resources, has left many roads administrations in developing countries with responsibilities for networks they can no longer maintain, let alone develop. Resources are spread too thinly, and the condition of road networks is deteriorating. It has been estimated that less than 50% of Sub-Saharan Africa's road network of about one million kilometers is in good condition and that 25% is in such poor condition as to require rehabilitation. Since restoration of networks to their former condition in the short term lies beyond the capacity of roads administrations, a more selective approach is required, e.g., a scale of road financing priorities should be drawn up to reflect the estimated pattern of transport demand, reconstruction and maintenance costs, as well as probable budgetary allocations, and a phased program that emphasizes maintenance rather than new construction should be formulated.

Designation of Roads Administrations

A second fundamental concern is where responsibilities for roads should lie. This has traditionally been regarded as a technical function and placed under the Ministry of Works or its equivalent. But there is a risk that too technical an approach may conflict with the economic and planning considerations that form an essential element of planning effective transport sector development. It is important that an agency such as a Ministry of Planning, concerned with the allocation of resources on a national scale, play an active part in inter-sectoral coordination and the integration of road financing into the broader economic planning framework.

Functions of Road Administrations

The road administrations, however organized, should be firmly committed to employing the limited resources at its disposal in the most cost-effective manner. In particular, pressure for new road construction should be resisted until the maintenance backlog has been substantially reduced. This is not always easy since national governments, and sometimes even donor agencies, are biased in favor of highly visible road construction, or are not fully aware of the importance of adequate maintenance. This has contributed to the maintenance backlog.

Construction, rehabilitation and maintenance standards should be appropriate, from a cost viewpoint, to vehicle weight regulations, traffic volumes, and vehicle fleet structure. Weight restrictions should be reviewed occasionally in relation to construction standards and, of course, enforced.

The scope should also be assessed for adopting new technologies and techniques that permit the substitution of readily available domestic resources for scarce productive factors, for example, the substitution of underemployed local labor for imported capital equipment to economize on foreign exchange. A complication arises here in that the potential savings from such measures are reflected in economic rather than financial costs. As this distinction may not be perceived by a roads administration accustomed to working in financial terms, close collaboration should be maintained with the planning and financial agencies to ensure that benefits of this type are identified and realized.

Financing of Road Administrations

The effective implementation of road construction and maintenance programs requires an adequate and stable supply of funds to roads administrations. Where roads are financed in part by general tax revenues, programs have been disrupted by unpredictable fluctuations in the flow of funds caused by economic pressure on, or inter-departmental competition for, government revenues.

One remedy is the establishment of a road fund financed by earmarked taxes or charges, normally, but not necessarily, on road users. This can help safeguard the roads administration from dependency on the treasury, guaranteeing a degree of stability in revenues and allowing greater independence in allocating funds among sector needs on the basis of professional judgment, free from the political motivation or lack of technical expertise common in central budgetary and financing agencies. Road maintenance, which has suffered particularly in this respect, would be more likely to be accorded its due priority over new construction.

On the other hand, certain disadvantages pertaining to road funds have often discouraged their adoption. They reduce the flexibility of government spending, preventing a full response to changing patterns of demand for public funds. Moreover, when road user taxes constitute an important part of general tax revenues, the remaining
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tax base may be inadequate for a viable road fund. The efficient use of resources within the sector may not be guaranteed, since roads administrations may be motivated by narrow technical, rather than economic, considerations in planning expenditures. Even when established, a road fund is not inviolable; instances of their suspension or "emergency borrowing" by the treasury to meet real or imaginary economic crises, can be found in countries as different as Burundi and the United Kingdom.

If circumstances do favor the introduction of a road fund, it is normally preferable that it be confined to the financing of road maintenance. New construction is better financed under separate arrangements where its economic justification can be assessed against the competing claims of investments in other sectors. Regular staff salaries and other unavoidable administrative expenditures, too, are probably best funded through normal channels. Even within the road fund, provisions should exist for testing the economic justification of maintenance programs.

Role of the Private Sector

An administration may choose to involve the private sector in road development for a number of reasons. Although this is more likely in the case of major construction and rehabilitation projects that may lie beyond the road administration's capacity, road maintenance is also sometimes contracted out, particularly for periodic resurfacing and rescaling works. Sometimes private contractors (or other non-governmental organizations) are engaged to complement the administration's work force in reducing a heavy maintenance backlog, as in Zaire; and occasionally an administration will engage local firms to maintain minor gravel roads, not because it lacks the resources to do it itself, but as part of a longer-term policy to encourage the emergence of a local contracting industry. Hiring of plant from privately operated equipment pools offers still another possibility for private sector involvement in road maintenance.

Taxation Criteria

The different taxation and charging options available in developing countries are reviewed below to assess the extent to which they can contribute to efficient resource use in the roads sector. It is assumed that no developing country will be able to afford a pure marginal cost pricing system, and that road user taxes will be expected to raise a surplus for general tax revenues. To be effective, taxes should be practical and feasible, given the social and administrative circumstances of the country concerned. Seven criteria have been suggested for such taxes:

- Administrative efficiency: difficult to evade, with collection costs accounting for no more than a small percentage of revenues.
- Effects on income distribution should be politically acceptable.
- Legal attempts to avoid a tax should not result in uneconomic consequences, as in a high gasoline tax encouraging a shift to diesel-powered vehicles.
- The tax base should be sufficiently broad to permit a small tax in percentage terms to generate a large amount of revenue.
- Taxes should be equitable in that the beneficiaries of the services provided are the principal taxpayers.
- Taxes should not have a marked inflationary effect.
- Tax yields should rise automatically with inflation.

Road user taxes are considered with these general requirements in mind, as well as for their sustainability for an appropriate cost pricing system.

Types of Road User Charges

Fuel Tax: Taxes on gasoline and diesel fuel, an important form of road user charge in most countries, meet the above criteria well. They are relatively easy to collect and can be raised at a port of entry, local refinery, or even as a sales tax. There is some risk that dependence on fuel taxes for general tax revenues may cause inter-sectoral or inter-modal distortions; in some countries, such as Somalia and Uganda, fuel taxes have accounted for more than three-quarters of total road user revenues. Another disadvantage with fuel taxes is that they can result in the uneconomic substitution of one type of fuel for another and, unless complex exonation arrangements are introduced, have an impact on consumption beyond the roads sector.

Fuel taxes are appropriate to a marginal price charging system in that they vary with distance, and influence the actual cost of making a journey. Fuel taxes, however, are not wholly ideal for this purpose. They increase with vehicle use and declining road quality, but they do so less than proportionately to corresponding road damage—fuel consumption per ton-km decreases inversely with vehicle weight while road damage increases. There is, consequently, a tendency to either over-collect from lighter vehicles and on better quality roads, or under-collect from the heavier vehicles that cause the most damage and on the lower standard roads where wear and tear is relatively high. It is necessary, therefore, if a close approximation to a marginal cost pricing
structure is to be achieved, to supplement fuel tax with other forms of road user charges.

In some countries fuel, far from being taxed, is actually subsidized with the aim of encouraging development through low transport cost or simply as a result of political pressure. But potential benefits, if any, are likely to be offset by the increased maintenance and operating costs resulting from the inefficient usage of the road system. Fuel subsidization in the road sector should be avoided.

Taxes on Vehicles, Spare Parts and Tires: Other taxes that vary with usage are import, excise, and purchase taxes on spare parts, tires and, to a lesser extent, vehicles. These taxes have some advantage over fuel taxes in countries with a high proportion of gravel and earth roads in that vehicles and tires sustain considerable wear on lower quality roads so that taxes imposed on their purchase reflect road usage. Vehicle parts and tire taxes correspond fairly well with the criteria given above and, used in conjunction with fuel tax, can be framed so as to bring road user charges more closely into line with actual marginal costs, perhaps by being imposed on the heavier vehicles that under-contribute under a regime based exclusively on fuel tax.

Distance Taxes: Other usage related taxes applicable to commercial vehicles are those levied directly on passenger fares and freight charges, reflecting both vehicle weight and distance traveled. But although such taxes are related to road damage, they do not correspond especially well with the general criteria, being costly to collect and open to evasion, particularly in countries with weak administrative systems. Sophisticated taxes of this type have been used in some developed countries, but they are not common in developing countries.

Tolls: Tolls are an extremely flexible form of usage-related charges in that they can be differentiated according to vehicle type, journey, length and time. Consequently, they are, in theory, particularly suitable for marginal cost pricing. In practice, tolls are only practicable under conditions of fairly heavy traffic flows yielding sufficient revenues to cover the costs of providing and maintaining collection and access facilities. Under light traffic conditions collection costs absorb a high proportion of revenues, or tolls have to be raised so far above marginal costs to deter transport operators from making economically desirable journeys. Tolls are, therefore, not common in developing countries, except on some heavily trafficked roads, (as in Mexico, Korea and the Philippines) and on some isolated feeder roads, as in Zaire, where local circumstances render evasion or misappropriation difficult.

Non-variable Vehicle Charges: Vehicle registration fees and licenses are non-variable in the sense that once paid, they no longer enter into an operator's decision whether or not to undertake a journey. As they do not vary with road usage they are not an effective form of charge for a marginal cost pricing system, nor are they particularly practicable, administratively speaking, as they require extensive and efficient record-keeping and must be collected from a large number of vehicle owners, offering opportunity for evasion and corruption. Yet, they are widely used in developing countries. They may be levied according to vehicle characteristics such as engine capacity, import price, vehicle weight, and axle weight, the latter offering the closest link with road damage. This is a useful charge for contributing to invariable road costs or general government revenues since they can be raised to whatever level the market will bear without significantly affecting subsequent road usage decisions.

Non-user Taxes: An alternative source of road financing is taxes on indirect beneficiaries of road services or even general tax revenues. In fact, full road cost recovery in developing countries with comparatively small vehicle fleets would have to resort to such sources. Although there is no theoretical pricing principle involved, it might be considered desirable, in the light of social equity criteria, to raise such taxes from indirect beneficiaries rather than general taxpayers. Two examples are a local sales tax on agricultural produce largely induced by a road improvement or a tax on local market stall holders benefitting from improved marketing prospects. Such taxes, not being directly linked to road usage, are not particularly appropriate in themselves for marginal cost pricing, but they can be used to complement a multi-part road user charging system as a means to correct for over dependence on usage-linked taxes.

Formulating an Economically Efficient Road User Charging System

In most Sub-Saharan African countries, revenues from road user charges are adequate to cover the construction, administration and maintenance costs of the road system. In some cases they yield a considerable surplus, as in Sudan, Zimbabwe and Cameroon, where they are estimated to have been more than double the expenditures. As taxes on road users are usually relied upon by governments as sources of general revenue, it is not always the case that the roads administration receives back in its budgetary allocation sufficient funds to sustain a desirable level of road expenditures. Moreover, even if achieved, total cost recovery does not necessarily guarantee consistency with the marginal
costs pricing principle that a user should incur on each journey charges at least equal to the variable maintenance costs imposed. There are a few instances of conscious attempts to adopt marginal cost principles, or even market correcting taxes at all, in national road user charging systems. Most tax systems have developed in a piecemeal manner, sometimes pre-dating independence, and, insofar as there is any rationale behind the charges, it is generally straightforward revenue raising, total sector cost recovery or, occasionally, a social objective such as income redistribution.

In formulating a road user charging system based on marginal cost principles, account must first be taken of other policy goals of the existing road tax system. If, for example, the government decides that road user charges should cover total roads sector expenditures and contribute to general tax revenues without undue distortion of demand, then these objectives should be regarded as constraints determining the extent to which marginal cost pricing or other market correcting principles can be incorporated within the tax structure. Political and administrative factors should also be considered. If, for example, record data is insufficient or adequate supervision is impracticable, then it would be unwise to introduce a distance tax on passengers and freight however theoretically attractive. Similarly, it may not be politically feasible to effect, as least in a single phase, the tax increase desirable for a marginal cost pricing system. Finally, transport coordinating requirements should be kept in mind; it would not, for instance, be economic to reduce a user charge to secure more efficient use of a low marginal-cost road if it would have the effect of diverting traffic from a railway offering even lower cost transport. In short, a second-best solution, featuring at least some of the benefits of marginal cost pricing, may have to be accepted in view of other policy goals, and of political and administrative constraints.

Subject to these constraints, the general approach that might be taken by a developing country wishing to restructure its road user charging system and obtain some of the benefits of marginal cost pricing, would be as follows. First, for reasons of internal financial discipline and the limited choice of taxation sources, a contribution from road users to fixed road costs and general tax taxation would probably remain necessary. But this should be raised only to the extent that the pattern of traffic usage is not distorted too far from that which would have resulted under a pure short-run marginal cost pricing policy. This type of distortion might occur if multi-axled commercial vehicles were so heavily taxed as to deter transporters from substituting them for road-damaging, two-axle rigid trucks.

Many countries adopt a fuel tax as the foundation of their user charging structure, both for its practical advantages and its correlation with road damage. The wide base of this tax also makes it a useful source of general tax revenues. But, in view of the tendency of a fuel tax to either over-collect on lighter vehicles or under-collect on heavier vehicles, it should be set such that it reduces over-recovery. It could then be supplemented by a charge on vehicles, tires or spare parts, imposed only, or principally, on heavier vehicles to bring their total charges more closely into line with their high marginal costs. But as under-recovery would still tend to emerge with increasing vehicle weight at the upper end of the range, vehicle registration fees bearing relatively heavily on these larger vehicles could be used as a further complementary pricing measure. Although not distance related, the incidence and level of registration fees can be finely ordered so as to redress, in average terms, the discrepancy between the charges and marginal costs of the heaviest vehicle classes. Also, as mentioned earlier, their neutral effect on shorter term usage, once they are paid, enables them to contribute effectively to general revenues, particularly at the local government level.

This general approach is illustrated schematically in Figure 1, which shows the general relationship these principles would establish between short-run marginal costs and road user revenues on a given road network. The diagram shows how total taxes levied on each vehicle type correspond to the short-run marginal costs, that is maintenance costs, imposed on the road network. In this illustration, revenues exceed costs in most cases. But the extent to which these surpluses will collectively exceed the corresponding shortfalls, yielding a contribution to invariable road costs and/or general tax revenues, will depend on the composition of the vehicle fleet. It should be appreciated, however, that the most appropriate structure and level of charges for developing a country will depend on national circumstances, including the extent and condition of the road network, composition of the vehicle fleet, elasticity of demand for road transport, and that it is unlikely that any two countries have the same optimum road pricing structure. The system outlined above for recovering road maintenance costs in an economically efficient manner should, therefore, be regarded as a general guide to be changed or modified as local conditions require.

Endnotes:

1. The concept of a "marginal cost" is rather more complex so it should not be regarded as always interchangeable with "variable cost."

2. See "Interim Guidelines on Road User Taxation" IBRD. Transportation Department. November 5, 1986. Table 1.
Figure 1: Specimen Structure of Road User Charging System

- Surplus of charges over costs (Available for contributions to invariable costs and general tax revenues after off-setting corresponding shortfalls of charges below costs)
- Shortfall of charges below costs

Variable Costs/User Charges

Vehicle Type

Private car

Road user tax

Pick-up

Short run variable costs

Light truck

Heavy truck

Truck/Trailer combination

Fuel Tax

Taxes on Vehicles, Tires, Spare Parts

Vehicle Registration Fee
Summary

The rapid expansion and upgrading of road networks in the 1970s in Sub-Saharan countries have not been matched with a commensurate increase in maintenance budgets and institutional capacities. Road damage has escalated well beyond the maintenance capacity of most highway agencies. Corrective measures require new skills, technologies, and management processes involving a sharp departure from traditional practices. In many road agencies, maintenance decisions are based on sources of information that are quite variable and often inconsistent. As a result, road agencies are unable to document the overall condition of their road systems, nor are they able to provide a defensible justification for their maintenance budget requests or render an acceptable accounting of the public funds expended on road maintenance and the results achieved.

Planning and Managing Public Expenditure on Roads

Planning, programming, and budgeting (PPB) are the basic processes for allocating, scheduling, spending, and controlling public funds for road development and maintenance programs. The PPB process involves intensive inter-agency interaction and coordination, with planning and budgeting functions managed by core ministries such as finance and planning. The programming activity is the only part of the PPB process directly managed and controlled by the road agency and hence is of critical importance in the rational application of road expenditures. The physical output of programming is a road development and maintenance program that can be a powerful management tool for phasing new projects, monitoring ongoing projects and activities, identifying a program slice for the annual budget, adjusting spending priorities under budget constraints, and providing factual information for preparing and monitoring the development plan and the budget. The spatially dispersed nature of maintenance activities, the wide span of management control, and structured delegation of authority from the maintenance headquarters at the apex to the maintenance crew at the lowest level of control, suggest that the programming and budgeting system supporting road maintenance management should have the following attributes:

- it should be based on physical monitoring and evaluation of the entire road network;
- it should have a multi-year horizon; and
- it should unify all maintenance operations ranging from routine maintenance to rehabilitation under a common system of resource allocation.

The development of a maintenance program and the accompanying budget requires an estimate of the maintenance work needed during the budget period and the cost of performing that work. While several approaches have been used to obtain these two items, a defensible maintenance program and budget must be based on reliable information on road conditions, traffic, and the cost of maintenance operations.

A number of management systems are available to provide factual information and criteria (performance and quantity standards), and a systematic approach to the effective programming, management, and application of road maintenance resources. Management systems, supported by effective information databases, have resulted in 5-15% savings in the annual budgets of road agencies. The main objective of these systems is to facilitate the processing and analysis of information for decision-making and management control. This objective can also be achieved with simple techniques (e.g., visual surveys and assessments) and manual record keeping, provided that information is collected and processed diligently and systematically.

In many road agencies, maintenance decisions are based on information that is variable and often inconsistent. As a result, road agencies are unable to document the overall condition of their road systems, justify their maintenance budget requests, or render an accounting of the public funds expended on road maintenance and the results achieved. With increasing pressures to control public spending, road agencies are being required to provide defensible and consistent justifications for their spending programs.
Budgeting for Road Maintenance

The main objective of the budget is to provide a meaningful and operational framework for accountability, while allowing for sufficient flexibility in the application of allocated funds. Ideally, the budget should be viewed as a contract committing the road agency to produce a quantum of work outputs for the financial resources it receives from the government. The budget should spell out the obligations and responsibilities of each party so there is a clear basis for auditing and assessing budget performance. There are three types of road maintenance budgets in common use: line-item, lump-sum, and program.

Experience suggests that program/performance-type budgets are best suited for road maintenance programs, as they are relatively simple to implement and strike an appropriate balance between the accountability and flexibility objectives of budgeting. A program budget also provides a basis for a "contract" between the government and the road agency that links funds allocation and physical outputs. The main caution in the use of this type of budget is to restrict maintenance activities or work items included in the budget to a manageable number. Otherwise the budget exercise can become complicated, costly and time-consuming. As with many other physical processes, about 20% of maintenance activities account for over 80% of the maintenance resources, and these key maintenance operations should be the focus of program budgets.

Maintenance by contract simplifies the use of program budgets, since a direct link is established between maintenance expenditures and physical outputs. Future maintenance cost estimates can be reliably prepared by the analysis of bids and completed maintenance contracts. Contract maintenance also provides considerable flexibility in adjusting maintenance programs in the face of budget cuts, as there are fewer resources tied up in components such as permanent labor and equipment, which tend to drive the scope and frequency of maintenance operations. Contract maintenance, however, requires a multi-year programming and budgeting cycle to ensure a steady flow of work for private contractors and to avoid delays in payment for completed work. If budget preparation is not based on a maintenance management system, it should be formulated on the basis of:

- inspection of roads, facilities, and equipment;
- the previous year's expenditure by major maintenance activities and past experience; and
- assessment of changed conditions such as adjustments in road inventory.

The budget preparation process can be significantly enhanced by establishing a maintenance budget review committee consisting of the chief maintenance engineer, a few district engineers representing field personnel, and one or more representatives of the planning and finance ministries.

Proposed expenditures by the road agency must be justified. This entails estimating the value of the capital represented by road network and the costs borne by the road users. The consequences of insufficient maintenance must be explained in terms of the deterioration of the road network, the eventual costs of deferred maintenance, and the higher costs sustained by road users. Major maintenance activities such as periodic resurfacing, strengthening and rehabilitation should be supported by quantified economic justification for each project or road link. Routine maintenance operations should be based on standards and levels of service derived from cost-effectiveness analysis.

There is generally no organized constituency to support or endorse the road maintenance program. The road agency should work with the media and potential interest groups (e.g., professional and trade associations of contractors and transporters) to make the political leadership and the public aware of the effects and costs of failing to maintain the roads.

Classification of Road Expenditures

Many countries have separate budgets for current and capital expenditures on roads with new road investments covered by the capital budget and maintenance under the current budget. The existence of two budgets is generally institutionalized in two budget-making bodies—Ministries of Finance often are responsible for current budgets while Ministries of Planning are in charge of capital budgets. Lack of coordination between the two has often led to inefficiencies in the allocation of resources to the road agency. Road construction and betterment programs are often fully funded in the capital budget while maintenance operations remain under-funded because of statutory ceilings on current expenditures. Where the two budgets are overseen by separate ministries, it becomes almost impossible to reallocate funds from new construction to maintenance and rehabilitation. Even where the management of the two budgets is unified under a single government agency, the rigidities of a dual budgeting system render such a reallocation difficult.

Incorporating certain road maintenance activities into the capital budget would help to reduce the bias toward investment in physical capital (new construction) at the expense of current operations and maintenance. For example, resurfacing (periodic maintenance) and rehabilitation of worn-out roads could reasonably be classed
as capital rather than current expenditure. Planners might then pay more attention to the need to maintain older roads and assess the future maintenance requirements of new construction projects. The budgetary constraints on rehabilitation would also be less rigid. Such a reclassification should also be helpful in reorienting the programs of external aid agencies. A more effective proposition would be to integrate capital and current budgets in a unified road budget and to select maintenance, rehabilitation and new construction projects on the basis of their economic worth. Whether unitary or dual, the budget should be comprehensive. It should include all spending on roads whether financed by general taxes, earmarked sources of revenue, borrowing or grants. Regardless of how road expenditures are classified, effective coordination between central ministries (finance and planning) and the road agency is essential to ensure adequate allocation and control of public funds for road construction and maintenance programs.

Integrating Donor-funded Projects into the PPB Process

Donors finance a large portion of road investment budgets in many sub-Saharan countries and their reluctance to fund current maintenance expenditures tends to complicate policymaking in the roads sector. In many countries donors deal directly with the road agencies, thus diluting the central control of the budget. Lack of a central perspective makes tradeoffs between road investments and maintenance difficult to assess and overall spending on roads difficult to contain. In some cases counterpart funds may be separated from the budget to support various donor-supported investment projects, leaving fewer resources for the road agency's maintenance programs.

Besides the need for change in donor policies on funding maintenance expenditures, all foreign aid for road programs should be incorporated in the central budget. Donor projects should be subject to the same standard of central review as domestically-financed road projects, with full attention paid to recurrent funding requirements. Donor activities should be incorporated into the normal programming and budgeting cycle so that availability of donor funding does not distort the spending priorities in the roads sector. This calls for more effective coordination of aid programs in the roads sector by borrower governments and their road agencies.

Release of Funds

To cope with uncertainties and budgetary shortages, central ministries often slow the release of funds to spending agencies. Such indirect forms of control, however, slow the implementation of maintenance programs and adversely affect the morale, staffing, and managerial capabilities of road maintenance organizations. Funding uncertainties play havoc with operations that cannot be uniformly programmed over the budget year because of a well-defined construction season. The release of maintenance funds by central ministries can be considerably streamlined if the road agency prepares reliable forecasts of its spending requirements.

The assurance of a steady and reliable flow of funds for maintenance programs is often used as an argument for special earmarked funds for roads. A road fund can ensure a steady source of funding for critical maintenance services and provide protection against unreliable disbursement procedures.

Program Adjustment under Budget Constraints

Budgetary shortfalls can make even a realistically planned road maintenance program obsolete, as funding for various categories of maintenance expenditures may fall below the minimum effective level. The problem may be further exacerbated if much of the budget goes toward the wages of a large labor force. A small cut can bring much of the agency's work to a standstill if, for example, it implies that the agency cannot buy fuel or spare parts. Even when funds have been appropriated for maintenance, political or private interests can pressure road authorities (or their financial sources) to divert funds. For these reasons setting priorities and developing contingency plans should be a part of the budgeting exercise. This can be accomplished in part by formulating a "core" maintenance program consisting of a group of roads and activities that should receive funding under all circumstances together with a list of activities to be funded as additional resources become available. The practice of "across-the-board" cuts or partially funding all maintenance activities should be abandoned.

Program Review and Evaluation

It is a common legal requirement that public expenditures on roads be subject to financial audits. Such audits mostly examine if funds were spent as authorized and put little emphasis on the value obtained from the public spending on roads. Periodic reviews of road maintenance programs should ensure an adequate link between physical and financial progress. A further objective of performance audits should be to relate financial flows and maintenance performance indicators to the state of the roads. Periodic reviews should be supplemented by a comprehensive retrospective evaluation reported annually in a public document. Such an evaluation should include an analysis of the objectives of each road maintenance activity, the progress made in
achieving these objectives, and an assessment of the benefits derived from maintenance activities.

**Introduction**

The rapid expansion and upgrading of road networks in the 1960s and 1970s (Table 1) has outstripped the maintenance budgets and institutional capacities of most countries in Sub-Saharan Africa. This road construction boom has doubled the paved road length since 1971, and in some countries has resulted in networks with a skewed age distribution, which concentrates major maintenance and strengthening requirements in cyclical periods, requiring a manifold increase in maintenance outlays. Deterioration of paved roads is gradual and barely perceptible during a long initial phase that can last up to two-thirds of the pavement's life cycle. This is followed by a rapidly escalating rate of deterioration leading to structural failure. Hence, resurfacing and strengthening requirements cannot be assessed accurately and programmed without a systematic procedure for pavement monitoring and evaluation (World Bank, 1988 b). Traffic has also become much heavier than expected and axle-loadings have exceeded the design capacity of pavements. Maintenance operations such as pavement resurfacing, strengthening, and rehabilitation can be as costly and technically complex as new road construction. Corrective measures therefore require new skills, technologies, and management processes involving a radical departure from traditional practices.

With increasing pressures to control public spending, road agencies are being required to provide a defensible and consistent justification for their spending programs. Traditional approaches to road planning, programming and budgeting (PPB) have focused mainly on new construction projects, relegating maintenance to a residual activity. This bias is still evident in the road expenditures. Based on a sample of 19 Sub-Saharan countries (Table 2), a number of countries mainly in Western Africa (Benin, Ghana, Nigeria and Togo), now recognize the need to increase allocations for maintenance and rehabilitation. For the 26 countries for which 1986-1988 data are available new construction and upgrading (excluding rehabilitation) accounted for 46% of road expenditures in Eastern and Southern Africa in 1987-88, compared to about 36% in Western Africa.

The increasing complexity and scope of maintenance operations has blurred the distinction between construction and maintenance activities. Maintenance can no longer be treated as a residual activity. Programming and budgeting practices for road expenditures must be overhauled so that road budgets bear some semblance to physical requirements and maintenance is accorded priority in budget allocations. The financial stakes are high—the restoration backlog alone is US$5.0 billion to rectify the past neglect of road maintenance in Sub-Saharan Africa (23% of paved roads and 39% of unpaved roads in poor condition) and another US$1.2 billion is needed annually for resurfacing, strengthening and routine maintenance to prevent deterioration of the remaining network.

The planning, programming, and budgeting process for road maintenance programs appears simple, but its implementation raises a number of policy and
operational issues. The purpose of this paper is to identify some of these issues and explore options for improving the programming and budgeting processes for road maintenance, including the use of management systems and related analytical tools. The planning techniques for road programs are fairly well established and are not covered in this paper. Although budgeting involves both revenue and expenditure, this paper deals mainly with the expenditure.

### Basic Concepts

Planning, programming, and budgeting are the basic processes for allocating, scheduling, spending, and controlling public funds for road development and maintenance programs. The medium-term plan (4-5 years) identifies sector development goals and objectives, evaluates spending categories and alternatives, sets the phasing of major capital investments over several years, and assesses the sustainability of planned expenditures and revenues over the plan period. In some countries, the medium-term plan is supplemented (and in some instances substituted) by annual plans to permit greater flexibility in addressing short-term problems and to achieve greater synchronization with the annual budget.

Programming translates the medium-term plan into a multi-year program of discrete projects and activities based on an assessment of expected resources and the absorptive capacity of the implementation agency. In case of road programs, this requires projections of the future physical and operational conditions and needs of the road system, establishment of spending priorities, and their phasing over a rolling three to five year period. Programs are quite specific for the first two years. The first year program becomes the basis for the budget and includes projects and activities with specific designs and detailed cost estimates. The second year program includes projects and operations at the design stage for inclusion in the following year's budget. The programs for the third and subsequent years identify the scope, design requirements, and estimated costs of planned expenditures. The program for each year should include separate estimates of investment and maintenance requirements for the road system. Compared to periodic updating of the medium-term plan (commonly a 4 or 5 year cycle) as part of a larger national planning exercise, the multi-year rolling program should be updated annually by the highway agency in conjunction with the annual budget exercise.

The budget is the authoritative legal document outlining the amount of money allocated for a specified time period to the road agency to spend on activities and functions for which it is responsible. The main purpose of the budget is to allocate resources to various activities and provide a basis for control. The maintenance budget is that portion of the road agency's budget that includes funds for maintaining roads, bridges, appurtenances, roadside, maintenance stations and equipment, traffic services, rest areas and other facilities and services. As shown in Exhibit 1, the PPB process involves intensive inter-agency interaction and coordination. The central planning office/ministry is commonly responsible for the economic development plan and for approving the development budget, while ministry of finance/office of the budget manages the current budget and controls all expenditures. The programming activity is the only part of the PPB process directly managed and controlled by the road agency and hence is of critical importance in the rational application of road expenditures.

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### Table 2. DISTRIBUTION OF ROAD EXPENDITURES: CONSTRUCTION VS. MAINTENANCE

(19 Sub-Saharan Countries)

<table>
<thead>
<tr>
<th>Percent Distribution of Road Expenditures</th>
<th>1981-82</th>
<th>1986-88</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Construction/Improvements</td>
<td>66%</td>
<td>58%</td>
</tr>
<tr>
<td>Reconstruction and Rehabilitation</td>
<td>13%</td>
<td>17%</td>
</tr>
<tr>
<td>Resurfacing and Routine Maintenance</td>
<td>20%</td>
<td>25%</td>
</tr>
</tbody>
</table>
Asif Faiz: Planning, Programming and Budgeting for Road Maintenance

Exhibit 1 - THE PPB PROCESS

The physical output of programming is a Road Development and Maintenance Program that serves as a management tool for phasing new projects, monitoring ongoing projects and activities, identifying a program slice for the annual budget, adjusting spending priorities to meet budget constraints, and providing factual information for preparing and monitoring the development plan and the budget.

Many road agencies perceive their role as an implementation agency responsible for executing programs and budgets given to them by core ministries such as finance and planning. Planning and budgeting are perceived as two distinctly different activities under separate departments with little or no interaction. The planning effort is focused on physical planning and design and budgeting is perceived mostly as a cost accounting exercise for controlling expenditures and justifying budget requests. Such road agencies are generally unable to make a convincing case for their programs and bear the brunt of budget cuts. For effective management of road expenditures, planning, programming and budgeting must be seen as an integrated process with programming providing the bridge between financial expenditures and physical outputs.

Exhibit 2. An Idealized Framework for Planning, Programming and Budgeting for Road Maintenance

(An idealized framework for the PPB process is shown in Exhibit 2). The spatially dispersed nature of maintenance activities, the wide span of management control, and structured delegation of authority from the maintenance headquarters at the apex to the maintenance crew at the lowest level of control, suggest that the PPB system supporting road maintenance management should have the following attributes:

- it should be based on physical monitoring and evaluation of the entire road network
- it should have a multi-year horizon
- it should unify all maintenance operations ranging from routine maintenance to rehabilitation under a common system of resource allocation.

Basic Information Requirements

The development of a maintenance program and the accompanying budget requires an estimate of the maintenance work needed during the budget period and the estimated cost of performing that work. While several approaches have been used to generate these estimates, the preparation of a defensible maintenance program and budget requires three basic elements:

- a link-by-link assessment of the condition of the road network and identification of major deficiencies.
- traffic distribution on the road network by volume and type of traffic.
- unit cost estimates for the main categories of maintenance operations including pavement resurfacing and routine maintenance, strengthening, rehabilitation, and reconstruction works.

Exhibit 2. AN IDEALIZED FRAMEWORK FOR PLANNING, PROGRAMMING AND BUDGETING FOR ROAD MAINTENANCE

An Operational Framework for Road Maintenance, Planning, Programming and Budgeting

Road maintenance planning and budgeting consists of the following essential procedures (FHWA, 1985):

- defining objectives and constraints
- assessing conditions and needs
- specifying work activities and standards
- developing annual work programs and budgets

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Road maintenance planning and budgeting consists of the following essential procedures (FHWA, 1985):

- defining objectives and constraints
- assessing conditions and needs
- specifying work activities and standards
- developing annual work programs and budgets
The condition assessment provides an inventory of maintenance elements and an estimate of the maintenance workload. The traffic data provide a key input the selection of appropriate maintenance policies and for prioritizing maintenance operations. Reliable unit costs permit the translation of the maintenance workload into a working budget. It is, however, not uncommon to find maintenance budgets assembled by multiplying aggregate road lengths (undifferentiated by traffic or condition) by unit costs of maintenance operations derived from largely theoretical desk exercises. Such a budget bears no resemblance to actual needs; it cannot be defended before decision-makers and is of no value in providing guidance to maintenance managers in the field. Reliable information on road conditions, traffic, and the cost of maintenance operations, and its regular updating through periodic surveys, are critical in terms of establishing realistic maintenance programs and budgets. Without this information, programming and budgeting becomes a sterile academic exercise, irrespective of the sophisticated procedures and models involved.

Management Information Systems for PPB

A "management information system" (MIS) provides information for determining the condition/status of assets, processes or activities and for making management decisions. MIS is a sub-set of a management system and provides information to support various components of the management system. Most of the developments in MIS are a by-product of the advances in micro-computer technology. (FHWA, 1985).

A number of systems are available to provide factual information and criteria (performance and quantity standards) for systematic approaches to the effective management and application of road maintenance resources. Management systems can add greatly to overall maintenance efficiency, resulting in a 5% to 15% savings in the annual budgets of road agencies (FHWA, 1985). Management systems, however, tend to address specific elements (e.g., pavements, bridges, equipment, maintenance) of the road management spectrum and have overlapping attributes. Generally, they are not integrated into a comprehensive road management system with appropriate information and feedback linkages between the various sub-systems.

The management systems commonly in use in road agencies to support the PPB process can be grouped into a hierarchy based on the object of management as shown in Table 3. These management systems have common information requirements (e.g., a geographic location system) and overlapping attributes (e.g., a features or asset inventory). A major challenge for road agencies is to:

- consolidate the information needs of various management systems into a common information system for road management;
- integrate the plethora of management systems into the organizational structure of the road agency as these systems often transcend the traditional organizational divisions based on functional responsibilities (e.g., planning, design, construction and maintenance);

<table>
<thead>
<tr>
<th>Object of Management</th>
<th>Activities</th>
<th>Information used for PPB</th>
</tr>
</thead>
<tbody>
<tr>
<td>A major component of the Road System</td>
<td>Pavement Management, Bridge Management, Roadside Management, Traffic Systems Management</td>
<td>Multi-year and annual maintenance work programs and budgets</td>
</tr>
<tr>
<td>A major operational function or activity performed on the Road System</td>
<td>Construction Management, Maintenance Management</td>
<td>Annual budgets, organizing, scheduling and controlling maintenance operations</td>
</tr>
<tr>
<td>A factor input needed for an operational function or activity</td>
<td>Equipment Management, Personnel Management, Materials Supply and Logistics Management</td>
<td>Procurement of equipment, personnel and materials needed for multi-year programs and related expenditures in the annual budget</td>
</tr>
</tbody>
</table>
• consolidate the enormous amounts of data generated by decentralized organizational units into information suitable for central management control and decision-making;

• mobilize the support and cooperation of field personnel in the introduction and operation of these management systems as they constitute an added administrative burden, often require the learning of new skills (computer technology), and are perceived as job-threatening; and

• establish a linkage between these operational management systems and financial accounting and control procedures and systems.

It is beyond the scope of this paper to attempt to discuss these issues. Suffice it to state that pavement and bridge management systems are essentially programming tools—they provide information on the state of roads and bridges and strategies for network-level programs and specific projects (resurfacing, strengthening, rehabilitation and reconstruction) within the program. Construction and maintenance management systems are used to plan, budget, and schedule maintenance and construction activities. These systems provide the cost information for construction and maintenance operations and estimates of workload requirements for scheduling. They include cost control and performance audit mechanisms and interface with central financial control and audit procedures. Equipment management and other related systems are aimed to maximize the productivity of equipment and other inputs (labor, materials) required for maintenance operations. The main objective of these systems is to facilitate the processing and analysis of information for decision-making and management control. This objective can be achieved equally well with simple techniques (e.g., visual surveys and assessments) and manual record keeping, provided that the information is collected and processed diligently and systematically. A simple but effective pavement management system is described in the Niger Case Study.

Budgeting Systems for Road Maintenance

The main objective of the budget is to provide a meaningful and operational framework for accountability, while allowing for sufficient flexibility in the application of allocated funds. The budget should be viewed as a contract between the road agency and the government, with the road agency committed to produce a quantum of work outputs for the financial resources it receives from the government. The budget should spell out the obligations and responsibilities of each party so that there is a clear basis for auditing and assessing budget performance at the end of the fiscal year. There are three types of road maintenance budgets in common use: line-item, lump-sum, and program (see Exhibit 3 for examples). In addition, Zero-based Budgeting (ZBB) has been used as a tool for budget justification.

Line-Item (Object of Expenditure) Budget

In this type of budget, maintenance allocations are determined on the basis of money instead of work to be accomplished. The budget lists proposed expenditures by basic items of expense: payroll, supplies and materials, equipment and, to some extent, contracted services. These amounts are sometimes listed separately under several activities to ensure availability of funds for specific services such as pavement marking, vegetation control, and rest area maintenance. With a line-item budget, the funds are used on basis of individual judgement instead of work objectives or comparative levels of service. Work decisions, for the most part, are made by the lowest level of supervisors and budget expenditures are not related to work outputs. Line-item budgets can be highly restrictive and offer little flexibility. For example, the allotment for any line item (such as materials) may not be exceeded even if there is an excess of funds in another line-item (e.g., equipment). This type of budget does offer some advantages in that it is easy to prepare as it requires simple projections of historic expenditure patterns and a known labor force. It is also easy to administer since the budget items are the same as the expense items incurred during budget execution.

Program/Performance Budget

The development of maintenance management systems and cost accounting procedures has led to changes in budget approaches. The program or performance budget (see Exhibit 4 for example) is based on detailed work programs broken down into activities (e.g., crack sealing, pothole patching, surface treatments, overlays), with predetermined estimates of work for each activity. The program budget defines the amount of work that is planned and expected to be performed. Senior management makes the decisions on the levels of service and work methods. This budget not only indicates what is to be accomplished but also what it will cost. It can also be used to demonstrate what will not be accomplished if the budget is significantly reduced. Some program budgets specify allocations for each major activity such as surface treatments. While expenditures may not exceed the allocations for specific activities, the program budget offers considerable flexibility in the use of component resources (labor, equipment, materials), which are not appropriated by each object of expenditure as in a line-item budget. The program budget offers the best balance between the flexibility and accountability principles underlying maintenance budgeting.
### Exhibit 3. TYPE OF ROAD MAINTENANCE BUDGETS

#### A. LINE-ITEM BUDGET

**SUMMARY**
- **Fund:** GENERAL  
- **Department:** HIGHWAYS  
- **Activity:** ROAD MAINTENANCE

<table>
<thead>
<tr>
<th>CLASSIFICATION</th>
<th>ACTUAL 1982</th>
<th>BUDGET 1983</th>
<th>BUDGET 1984</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal Services</td>
<td>65,429.18</td>
<td>83,198.00</td>
<td>87,927.00</td>
</tr>
<tr>
<td>Contractual Services</td>
<td>6,312.18</td>
<td>7,000.00</td>
<td>7,500.00</td>
</tr>
<tr>
<td>Commodities</td>
<td>4,450.02</td>
<td>3,540.00</td>
<td>4,450.00</td>
</tr>
<tr>
<td>Other Charges</td>
<td>19,946.15</td>
<td>22,000.00</td>
<td>26,500.00</td>
</tr>
<tr>
<td>Gross Expenditures</td>
<td>96,137.53</td>
<td>115,738.00</td>
<td>126,377.00</td>
</tr>
<tr>
<td>Reduction of Costs</td>
<td>1,129.62</td>
<td>2,500.00</td>
<td>2,500.00</td>
</tr>
<tr>
<td>Net Expenditures</td>
<td>95,007.91</td>
<td>113,238.00</td>
<td>123,877.00</td>
</tr>
</tbody>
</table>

#### B. PERFORMANCE BUDGET

**SUMMARY BUDGET REPORT**
- **Fiscal Year:** 1982  
- **Department:** HIGHWAYS  
- **Activity:** ROAD MAINTENANCE

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>ACTIVITY</th>
<th>WORK AND COST</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>In-House</td>
<td>Contract</td>
<td></td>
</tr>
<tr>
<td>1101</td>
<td>Spot Premix Patching</td>
<td>Work</td>
<td>8050.00</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Units: Sq. Feet</td>
<td>Cost</td>
<td>33,407.50</td>
</tr>
<tr>
<td>1103</td>
<td>Recycle Asphalt Patching</td>
<td>Work</td>
<td>2010.00</td>
<td>500.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Units: Sq. Feet</td>
<td>Cost</td>
<td>10,271.10</td>
</tr>
<tr>
<td>1100</td>
<td>Roadway Maintenance</td>
<td>Cost</td>
<td>43,678.60</td>
<td>2485.00</td>
</tr>
<tr>
<td>3201</td>
<td>Roadway Mowing</td>
<td>Work</td>
<td>873.00</td>
<td>315.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Units: Swath Mi</td>
<td>Cost</td>
<td>3,622.95</td>
</tr>
<tr>
<td>3204</td>
<td>Litter Pickup</td>
<td>Work</td>
<td>375.00</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Units: Man Hrs.</td>
<td>Cost</td>
<td>5,632.50</td>
</tr>
<tr>
<td>3200</td>
<td>Roadside Services</td>
<td>Cost</td>
<td>9,255.45</td>
<td>1,332.45</td>
</tr>
<tr>
<td></td>
<td>Total All Activities</td>
<td>Cost</td>
<td>52,934.05</td>
<td>3,817.45</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>35,683.32</td>
<td>2,573.09</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>88,617.37</td>
<td>6390.54</td>
</tr>
</tbody>
</table>

#### C. LUMP-SUM BUDGET

**RECURRENT BUDGET ESTIMATE**

<table>
<thead>
<tr>
<th>CODE</th>
<th>SUBJECT</th>
<th>ACTUAL 1982</th>
<th>REVISED EST. 1983</th>
<th>EST. 1984</th>
</tr>
</thead>
<tbody>
<tr>
<td>000314</td>
<td>Maintenance of Highways</td>
<td>95007.91</td>
<td>113,238.00</td>
<td>123,877.00</td>
</tr>
</tbody>
</table>

Lump-Sum Budget

With this type of budget, funds are appropriated in one lump sum for maintenance purposes and appear as a single-line item. Although this budget allows the greatest flexibility, budget preparation must be based on a sound physical program and performance closely scrutinized to ensure accountability. The use of a lump-sum budget should be predicated on the presence of an advanced maintenance programming and evaluation capability.

Other Budgetary Systems

Two other budgetary systems have been used in public works programs. These include the Planning, Programming and Budgetary System (PPBS) introduced in the U.S. Department of Defense in the 1960s and the Zero-Based Budgeting (ZBB) introduced in the U.S. federal government in 1977 to screen out the historic continuation of unneeded programs. Both these systems involve complex goal-setting exercises and focus on processes rather than results. Neither has proved an effective budgetary system for road maintenance. Experience suggests that program/performance-type budgets are best suited for road maintenance programs, as they are relatively simple to implement and strike an appropriate balance between the accountability and flexibility objectives of budgeting. Furthermore, a program budget provides a basis for establishing a "contract" between the government and the road agency by providing a linkage between allocation of funds and physical outputs. The main caution in the use of this type of budget is to restrict maintenance activities or work items included in the budget to a manageable number. Otherwise the budget exercise can become complicated, costly, and time-consuming. As with many other physical processes, about 20% of maintenance activities account for over 80% of the maintenance resources and these key maintenance operations should be the focus of program budgets. Where labor redundancy is an issue, program budgets may be reinforced by numerical limits on the labor force that the road agency may hire. This option may raise costs if there are cyclical peaks in the maintenance work load.

Maintenance by contract simplifies the use of program budgets, since a direct link is established between maintenance expenditures and physical outputs. The intermediate step of estimating factor inputs (labor, equipment, materials) can be dispensed with except for establishing initial base contract rates and periodic checks on contract bids. Future maintenance cost estimates can be reliably prepared using information from analysis of bids and completed maintenance contracts. Contract maintenance also provides considerable flexibility in adjusting maintenance programs in the face of budget cuts, as there are fewer resources tied up in non-fungible factor components such as permanent labor and equipment, which otherwise tend to drive the scope and frequency of maintenance operations. Contract maintenance, however, requires a multi-year programming and budgeting cycle to ensure a steady flow of work for private contractors and to avoid delays in payment for completed work.

Classification of Road Expenditures

The most important distinction in road budgets is the separation between current and capital transactions. Some countries have separate budgets for current and capital expenditures on roads. Dual budgets originated in the 1930s with the idea that the current budget (covering current expenditures) was to be financed by taxation and the capital budget (covering the acquisition of new assets that would generate returns in the future by borrowing and other capital revenues. This distinction is based on the premise that borrowing to fund consumption is not acceptable. There are several variants on the current/capital theme: recurring and nonrecurring, ordinary and extraordinary, revenue and capital, current and investment, above and below the line, and development and maintenance budgets (Pem-chand, 1983). Implementation of development plans has led to a frequent association of new road investments with the capital budget and maintenance with the current budget. The existence of two budgets is generally institutionalized in two budget-making bodies—Ministries of Finance often are responsible for current budgets while Ministries of Planning are in charge of capital budgets. Lack of coordination between the two has often led to inefficiencies in the allocation of resources to the road agency. Thus, it is not unusual for road construction and betterment programs to be fully funded in the capital budget whereas maintenance operations remain underfunded because of statutory ceilings on current expenditures. Where the two budgets are overseen by separate ministries, it becomes almost impossible to reallocate funds from new construction to maintenance and rehabilitation. Even where the management of the two budgets is unified under a single government agency, the rigidities of a dual budgeting system render such a reallocation difficult.

Road expenditures in Mauritius (Table 4) clearly show the problems associated with dual budgets. The growing imbalance between capital and current expenditures between 1983/84 and 1987/88 is readily apparent, with expenditures on maintenance stagnating over the five-year period. It is interesting to note that the distribution of budgetary resources between periodic and routine maintenance within the current budget appears quite reasonable. Only in the broader context of overall road expenditures does the imbalance between investments and maintenance become apparent.
Exhibit 4. MAINTENANCE PERFORMANCE BUDGET SUMMARIES

A. Maintenance District Level

<table>
<thead>
<tr>
<th>WORK PROGRAM</th>
<th>OBJECT OF EXPENDITURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>CODE</td>
<td>MAINTENANCE ACTIVITY</td>
</tr>
<tr>
<td>ROADWAY SURFACE</td>
<td></td>
</tr>
<tr>
<td>101</td>
<td>Patch with premix</td>
</tr>
<tr>
<td>102</td>
<td>Level with premix</td>
</tr>
<tr>
<td>103</td>
<td>Deep patch with premix</td>
</tr>
</tbody>
</table>

| 198          | Other roadway        | 1,500 man days | 1,500   | 26,500  | 19,570      | 8,210       | -                         | 61,760         |

| SUB-TOTAL ROADWAY |                       |               |         |         |             |             |                          |                |
| 15,548         | 237,100              | 229,110       | 290,550 | 43,200  | 936,050     |              |                          | 326,050        |

| SHOULDER AND SIDE APPROACHES |                       |               |         |         |             |             |                          |                |
| 201          | Blade/Rebase        | 7,200 shoulder | 1,900   | 4,200   | 99,200      | 1,520       | -                         | 144,000        |
| 202          | Patch with aggregate | 9,000 average | 220     | 5,880   | 5,180       | 10,800      | -                         | 21,040         |
| 203          | Other shoulder activities | 900 man days | 500     | 21,600  | 11,980      | 9,610       | -                         | 42,190         |

| SERVICES AND OVERHEADS |                       |               |         |         |             |             |                          |                |
| 901          | Employment Services and repair | 3,200 vehicles | 400     | 9,600   | -           | 540         | -                         | 10,140         |
| 951          | Field Supervision   | 9,000 man days | 9,000   | 144,000 | 36,000      | -           | -                         | 190,000        |
| 952          | Laborers           | 9,000 man days | 9,000   | 220,600 | -           | -           | -                         | 220,600        |

| DISTRICT TOTAL BEFORE ADJUSTMENTS |                       |               |         |         |             |             |                          |                |
| 55,600       | 1,405,200           | 827,660       | 1,015,580 | 58,750  | 3,347,180   |              |                          | 3,373,040      |

| DISTRICT MAINTENANCE BUDGET |                       |               |         |         |             |             |                          |                |
| 1,461,600    | 827,660             | 1,015,580     | 58,750  | 3,373,040 |              |              |                          |                |

B. Highway Agency Level

<table>
<thead>
<tr>
<th>WORK PROGRAM</th>
<th>OBJECT OF EXPENDITURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>CODE</td>
<td>MAINTENANCE ACTIVITY</td>
</tr>
<tr>
<td>ROADWAY SURFACE</td>
<td></td>
</tr>
<tr>
<td>101</td>
<td>Patch with premix</td>
</tr>
<tr>
<td>102</td>
<td>Level with premix</td>
</tr>
<tr>
<td>103</td>
<td>Deep patch with premix</td>
</tr>
</tbody>
</table>

C. Planning/Finance Level

<table>
<thead>
<tr>
<th>OBJECT OF EXPENDITURE</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Roadway Surfaces</td>
<td>1,415</td>
</tr>
<tr>
<td>Shoulders and Side Approaches</td>
<td>206</td>
</tr>
<tr>
<td>Drainage</td>
<td>391</td>
</tr>
<tr>
<td>Roadside</td>
<td>1,100</td>
</tr>
<tr>
<td>Major Structures</td>
<td>307</td>
</tr>
<tr>
<td>Snow &amp; Ice Control</td>
<td>602</td>
</tr>
<tr>
<td>Traffic Services</td>
<td>988</td>
</tr>
<tr>
<td>Extraordinary Maintenance</td>
<td>83</td>
</tr>
<tr>
<td>Service Functions &amp; Overheads</td>
<td>1,057</td>
</tr>
<tr>
<td>Retirement</td>
<td>91</td>
</tr>
<tr>
<td>STATE MAINTENANCE BUDGET</td>
<td>6,220</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Expenditure Percentage</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>42</td>
<td>23</td>
</tr>
</tbody>
</table>

Table 4. MAURITIUS: EXPENDITURE ON ROADS

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A. Capital</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Road Construction</td>
<td>5.1</td>
<td>18.5</td>
<td>58.3</td>
<td>148.2</td>
<td>213.8</td>
</tr>
<tr>
<td><strong>B. Current</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Road Maintenance</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Routine</td>
<td>2.8</td>
<td>2.8</td>
<td>2.6</td>
<td>3.0</td>
<td>4.2</td>
</tr>
<tr>
<td>- Periodic</td>
<td>9.9</td>
<td>10.5</td>
<td>10.4</td>
<td>11.2</td>
<td>10.9</td>
</tr>
<tr>
<td>Administration g/</td>
<td>29.6</td>
<td>29.7</td>
<td>31.0</td>
<td>31.2</td>
<td>35.4</td>
</tr>
<tr>
<td>TOTAL</td>
<td>47.4</td>
<td>61.5</td>
<td>102.3</td>
<td>193.6</td>
<td>264.3</td>
</tr>
</tbody>
</table>

*Includes personnel, emoluments and other charges such as travelling, office expenses, etc.

Source: Ministry of Works, November 1988

The traditional criteria for classifying expenditures under the capital budget are (Premchand, 1983):

- the productivity or the revenue (income) producing capability of the proposed expenditures, normally through creation of tangible assets.
- life expectancy of the asset created; assets with a life span longer than one year are included in the capital budget.

The strict application of these criteria to road maintenance activities is rendered difficult as maintenance operations do not create tangible assets. Maintenance helps to extend the life of existing assets or income producing capability.

A somewhat looser interpretation of the above criteria would qualify periodic road resurfacing, pavement strengthening, and rehabilitation works as capital expenditures. The expected service life of these works is more than one year, and they help to protect and in some cases expand the revenues generated by road users (through taxes on fuel and vehicles, tolls, etc.). The revenue receipts, however, form part of a general pool or a road fund and cannot be directly linked to specific road maintenance or construction expenditures. Another approach to classifying road maintenance expenditures is provided by the treatment of outlays on repairs in the UN System of National Accounts. Outlays on repairs are distinguished as "current" or "capital." Current repairs are those that keep the assets "in proper working order", while capital outlays on repairs are those that "lengthen the expected normal lifetime use of fixed assets or increase the productivity of these goods significantly". In order to be classified as capital, the outlays should be "substantial" (Premchand, 1983). This approach would suggest that most road maintenance expenditures including a substantial element of routine maintenance (e.g., patching potholes, blading gravel roads) could be considered as capital outlays on repairs and included in the capital budget.

The bias toward investment in physical capital could be reduced by incorporating certain road maintenance activities in the capital (new construction) at the expense of current operations and maintenance. For example, resurfacing (periodic maintenance) and rehabilitation of worn-out roads can reasonably be classed as capital rather than current expenditure. Planners might then pay more attention to the need to maintain older roads and to assess the future maintenance requirements of new construction projects. The budgetary constraints on rehabilitation would also be less rigid. Such a
reclassification should also be helpful in reorienting the programs of external aid agencies. The arguments for reclassifying expenditures should only be used where existing conventions distinguishing between current and capital cannot be altered, not when budget reform is the object.

It might be even more effective to integrate capital and current budgets into a unified road budget and to select maintenance, rehabilitation and new construction projects on the basis of their economic worth, taking into consideration the future streams of expenditures and benefits (road user savings) in each case.

Whether unitary or dual, the budget should be comprehensive. It should include all spending on roads whether financed by general taxes, earmarked sources of revenue, borrowing or grants. Regardless of how road expenditures are classified, effective coordination between central ministries (finance and planning) and the road agency is essential to ensure adequate allocation and control of public funds for road construction and maintenance programs.

Integrating Donor-Supported Projects in the PPB Process

Donors finance a large portion of road investment budgets in many Sub-Saharan countries, up to 95% in some countries. The extensive donor involvement coupled with their reluctance to fund current maintenance expenditures tends to complicate policy-making in the roads sector. In many countries, donors deal directly with the road agencies, thus diluting the central control of the budget. Lack of a central viewpoint makes tradeoffs between road investments and maintenance difficult to assess and overall spending on roads difficult to contain. In some cases counterpart funds may be separated from the budget to support various donor-supported investment projects, leaving few resources for the road agency’s maintenance programs. In addition, the refusal of some donors to fund current spending on maintenance can aggravate domestic budgetary pressures or reduce effectiveness (World Bank, 1988, b).

Besides the need for change in donor policies on funding maintenance expenditures, all foreign aid for road programs should be incorporated in the central budget. Donor-supported projects as well as domestically-financed road operations should be subject to a process of evaluation and prioritization in which due attention is paid to recurrent funding requirements. Donor activities should be incorporated into the normal programming and budgeting cycle so that availability of donor funding does not distort the spending priorities in the roads sector. This calls for more effective coordination of aid programs in the roads sector by borrower governments and their road agencies.

Key Considerations in Budget Preparation and Implementation

Budget Formulation

Lacking political support and shielded from market pressures, the budgets for road maintenance are often unrelated to known requirements. The preparation of the road maintenance budget, therefore, should start at the smallest accounting unit in the maintenance organization, normally the district or the sub-district level, to ensure that the maintenance budget bears some semblance to physical maintenance requirements, which may be dispersed over a large territorial area. A correspondence between the physical implementation unit and the budgetary accounting unit helps to enhance the accountability aspects of budgeting. If budget preparation is not based on a maintenance management system, it should be formulated on the basis of:

- inspection of roads, facilities, and equipment;
- the previous year’s expenditure by major maintenance activities and past experience; and
- assessment of changed conditions, such as adjustments in road inventory.

The budget preparation process can be significantly enhanced by establishing a maintenance budget review committee consisting of the chief maintenance engineer, a few district engineers representing field personnel, and one or more representatives of the planning and finance ministries (Kelly, 1981). An example of a performance-type maintenance budget as it is processed from the district level to its final submission to the central budget agency is shown in Exhibit 4 (Jorgensen et al. 1972).

Justification of the Budget

As in any well managed business organization, proposed expenditures by the road agency must be justified. First, this entails estimating the value of the capital represented by the road network and the costs borne by the road users. The consequences of prolonged insufficient maintenance must be explained in terms of the deterioration of the road network, the eventual costs of deferred maintenance, and the higher costs sustained by road users. All major maintenance activities, such as periodic resurfacing, strengthening, and rehabilitation should be supported by a quantified economic justification for each project or road link. Routine maintenance
operations should be based on a set of standards and levels of service derived from an analysis of cost-effectiveness. Road maintenance standards and expenditures should be related to traffic volumes, and not to the class of road, if it is accepted that the main purpose of roads is to carry traffic. Justification for an increased road maintenance program, as exemplified in the Nigeria Case Study, is presented in the Nigeria Case Study.

While it is possible to carry out such an analysis without the use of computer models, as exemplified in the case study on the Ghana Road Stabilization Program, a number of computer models—for example HDM-III (World Bank) and RTIM (TRRL)—have been developed to evaluate road maintenance strategies and programs. These models can help to make a convincing case to legislatures and top decision-makers for adequate funding for road maintenance. HDM-III can also be coupled with the companion EBM to find the best way of using road agency funds under budget constraints. Within the planning, budgeting, and programming functions of a highway agency, the model can be used to establish budget levels that minimize the total cost of road transportation, policies and standards for construction and maintenance programs consistent with minimizing total transport costs given resource constraints, and medium- and long-term investment and expenditure programs.

Mobilizing Public Support

There is generally no organized constituency to support or endorse the road maintenance program; thus the justification of the maintenance budget falls primarily on the road agency. Planned use of the media at budget time can be an asset, but road maintenance is a perennial function and should be supported by a year-round budget selling job. Periodic press releases and presentations to professional, social or civic groups can be part of the marketing of road maintenance, particularly if the road agency has an effective public relations office. Opportunities should also be provided to elected officials and the public to provide organized and systematic inputs into the budget process. The road agency should work with the media and potential interest groups (e.g., professional and trade associations of contractors and transporters) to make the political leadership and the public aware of the effects and high costs of failing to maintain the roads (World Bank, 1986).

Release of Funds

To cope with uncertainties and budgetary shortages, central ministries often slow down the release of funds to spending agencies. Slow release of funds is often an easier way of controlling a budget than denying funding requests when budgets are formulated. Such indirect forms of control, however, slow the implementation of maintenance programs and adversely affect the morale, staffing, and managerial capabilities of the road maintenance organization. Funding uncertainties play havoc with road maintenance operations that cannot be programmed uniformly over the budget year because of a well-defined construction season.

The release of maintenance funds by central ministries can be considerably streamlined if the road agency prepares reliable forecasts of its spending requirements. Such forecasts should be based on commitments made and expected payments with a small amount added for contingencies. The original budget submission should include a quarterly estimate of spending requirements. These quarterly estimates should be revised once the maintenance budget has been approved or the road agency has received authority to incur expenditures. The assurance of a steady and reliable flow of funds for maintenance programs is often used as an argument for special earmarked funds for roads. A road fund can reduce the political inefficiency inherent in the allocation of general funds. Where effectively managed, it can ensure a steady source of funding for critical maintenance services and provide protection against unreliable disbursement procedures.

Program Adjustment under Budget Constraints

Road agencies often overprogram to protect their operations from arbitrary cuts by finance and planning ministries and pay too little attention to priorities, resource constraints, or phasing. Unexpected budgetary shortfalls, however, can make even a well-planned road maintenance program obsolete, as funding for various categories of maintenance expenditures may fall below the minimum effective level. The problem may be further exacerbated if much of the budget goes toward the wages of a large labor force. The disposable portion of the budget fluctuates much more than the total when budgets are cut or prices rise. A small cut can bring much of the agency’s work to a standstill if, for example, it implies that the agency cannot buy fuel or spare parts. Moreover, even when funds have been appropriated for maintenance, political or private interests put pressure on road authorities (or their financial sources) to divert funds to other purposes. Such interference, often becomes one of management’s biggest challenges (World Bank 1988). For these reasons setting priorities and developing contingency plans should be a part of the budgeting exercise. This can be accomplished in part by formulating a “core” maintenance program consisting of a group of roads and activities that should receive funding under all circumstances (e.g., basic routine maintenance, patching, blading, safety-related maintenance, and high priority resurfacing and rehabilitation works) together
Asif Faiz: Planning, Programming and Budgeting for Road Maintenance

with a list of activities to be funded as additional resources become available. The practice of “across-the-board” cuts or partial funding of all maintenance activities should be abandoned. Common techniques used by central ministries for reducing budgetary expenditures associated with these techniques are shown in Table 5.

Program Review and Evaluation

It is a common legal requirement that public expenditures on roads be subject to financial audits. Such audits mostly examine if funds were spent as authorized and put little emphasis on the value obtained from the public spending on roads. Periodic reviews of road maintenance programs should ensure an adequate linkage between physical and financial progress. Such reviews should identify the lags in physical progress as well as areas where money expenditures are ahead of physical progress. A further objective of performance audits should be to relate financial flows and maintenance performance or technical indicators to the state of the roads.

Periodic reviews should be supplemented by a comprehensive retrospective evaluation reported annually in a public document. Such an evaluation should include an analysis of the objectives of each road maintenance activity and the progress made in achieving these objectives; an examination of the effectiveness of the procedures, schedules, and factor inputs (labor, equipment and materials) used for implementation of the maintenance program; and an assessment of the benefits derived from maintenance activities.

A major issue in program review and evaluation is the location of the evaluation authority. It might be argued that if the evaluation authority were located in the road agency, it could be used in a self-serving manner, mainly to obtain additional funds for the road programs. Given the technical and specialized nature of road programs, the evaluation authority should reside in the road agency but the evaluation unit or department should have sufficient independence so that the objectivity of the evaluation process is not compromised. This can be best achieved by having an experienced senior officer head the evaluation unit, reporting directly to the minister or head of the road agency (Premchand, 1983).
### TABLE 5. TECHNIQUES FOR TRIMMING BUDGETARY EXPENDITURES

<table>
<thead>
<tr>
<th>Nature of Technique</th>
<th>Measures Used</th>
<th>Implications for Road Maintenance Operations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Across-the-board cuts in expenditures; rescissions.</td>
<td>General percentage cuts in all activities.</td>
<td>Mainly affects the disposable portion of the road maintenance budget (operating expenditures, fuel, spares) as the wage bill cannot be reduced in the short term. A small cut can bring the maintenance operation to a standstill.</td>
</tr>
<tr>
<td>Specific activity cuts: impoundments of funds or activities.</td>
<td>Elimination of expenditures on specific maintenance.</td>
<td>Lowering maintenance service levels (e.g., frequency of routine operations), elimination of some maintenance activities, and network contraction.</td>
</tr>
<tr>
<td>Selection of high-yielding operations.</td>
<td>In the context of a resource squeeze reliance is placed on maintenance operations that have lower agency costs but still yield high economic return.</td>
<td>Substitution of overlays by seal periodic resurfacing by more intensive patching. Reducing frequency of blading and regravelling.</td>
</tr>
<tr>
<td>Reduction in expenditure on personnel</td>
<td>Reduction in administrative posts and not filling existing posts.</td>
<td>Short-term effect on the budget is minimal but provides a good strategy for reducing the maintenance wage bill over time.</td>
</tr>
<tr>
<td>Quarterly cash management budgets: cash limits and other adjustment mechanisms.</td>
<td>Release of quarterly apportionments to road agency so that they remain within limits of specified resources for maintenance. Adjustment within those ceilings is a matter for the road agencies to decide.</td>
<td>Not an effective technique for maintenance programs as maintenance work load is not evenly adjustment distributed over time and is subject to peaks resulting from climatic and geographical conditions.</td>
</tr>
</tbody>
</table>

*Source: Adapted from Premchand (1983).*

### References


Robert C. Petts
Road Maintenance Management and Operational Planning

Summary

This paper proposes policy objectives in the area of road maintenance management with reference to operational planning, programming and monitoring, and presents options and actions for achieving these objectives.

Planning can be shown to be required at two distinct levels with respect to road maintenance (Figure 1). At the upper level network planning deals with the management of the highway network, of which road maintenance is but one component. At the other level is operational planning which deals more with the resources directly allocated to road maintenance. Both planning roles are crucial to the successful management and maintenance of the road network.

Network and Operational Planning

The road network is a national asset that must be managed effectively to enable an efficient transport sector to support economic development. To manage the network effectively, policies need to be developed as a working framework for both investment in and maintenance of the road network. These policies should cover at least the following areas:

- the balance between road agency and road user costs;
- the distribution of available road sector funding between construction, rehabilitation and maintenance;
- the extent of road network wholly maintainable using central organisation and funding: responsibilities, funding and resourcing for the remainder of the road network;
- appropriate geometric and serviceability standards for various categories of roads; realistic road maintenance objectives, both long term and intermediate; road maintenance priorities;
- upgrading criteria: earth to gravel, gravel to bitumen/concrete standards;
- the utilisation of finite or limited national resources such as gravel, bitumen, cement;
- the utilisation of local resources such as labour, simple equipment or the private sector; and
- the management of axle loading on the road network.

Some of these operational policies have a significant political dimension. All of them must be tackled to ensure effective management of the road network. In order to develop these network planning policies, it is necessary to have:

- an institutional framework that will enable policies to be developed, agreed and implemented;
- the resources required to collect, process and present the necessary data;
- the systems to process the data and develop the policy options for discussion at senior management and political levels; and
- the trained, experienced, and motivated manpower to carry out the planning functions.

Critical appraisal of the network planning function in most road authorities will show deficiencies in the above requirements.

Because of this the road maintenance authority is often unable to perform several functions including: demonstrating to political authorities and the general public the importance of road maintenance; mobilising appropriate or adequate finances for road maintenance; presenting coordinated policies to donors and facilitating rational investment in the road sector; optimising the use of locally available resources including the private sector. Figure 2 illustrates the suggested framework for action.
Operational Planning

Operational planning, programming and monitoring (PPM) concerns the management of the funds and resources allocated, particularly to road maintenance. The principal operational road maintenance functions are related in a fairly simple annual cycle. Figure 3 illustrates this flow of functions commencing with establishing and quantifying maintenance needs.

The planning functions should, of course, commence well in advance of the maintenance funding year. Monitoring and reporting will feed back into the planning process for subsequent years. Each of these functions will contribute to the effectiveness of road maintenance. Collectively the PPM functions will have a significant influence on overall road maintenance performance.

PPM can be constrained by the following factors:

- organisational framework and individual responsibilities inappropriate for effective PPM;
- no budget for PPM functions;
- appropriate procedures and systems not established to carry out the PPM functions;
- personnel resources not provided, trained or motivated to carry out the PPM functions;
- insufficient data or access to data to carry out specific PPM functions;
- physical resources not provided, e.g., survey equipment and transport;
- lack of guidelines regarding priorities and intervention criteria;
- constraints not properly identified and tackled;
- technology or implementation options not available;
- insufficient or irregular flow of funds.

These factors constrain effective operational planning, programming and monitoring with knock-on consequences for deficiencies in the following areas:

- management of financial resources,
- management of physical resources,
- use of local resources and the private sector,
- internal accountability.

These are the key first-level issues related to Maintenance Management which should be effectively tackled if road maintenance performance is to be improved. Figure 4 illustrates the suggested framework for action.

Options for Improving Road Maintenance Management

This section discusses the options for improving road maintenance performance; it considers improvement options regarding functional separation, resources, data requirements, systems, and personnel aspects.

Functional Separation

It is often asserted that the field engineer knows his network, particularly in an objective way. In fact, he will probably not appreciate the options for maintenance interventions and the full associated costs and benefits to the network. Furthermore, high turnover in staff and other duties may prevent the engineer from becoming acquainted with his network or its needs. In addition, accountability is very difficult to achieve when the same person is identifying needs, planning, organising, controlling and reporting the work to a senior or central remote person.

There is a strong case for separating the operational planning and monitoring functions from the scheduling and implementing functions. This is usually successfully achieved for construction works where accountability in terms of completing works to time, to specification and to cost against planned criteria is possible. Without separate planning and monitoring functions it is very difficult to plan the best use of available road maintenance resources and to be satisfied that the work is carried out effectively and efficiently.

The separation of the operational planning and monitoring duties from implementation also allows flexibility regarding the following options for maintenance implementation:

- Force Account (Direct Labor)
- Contractor (Individual or Company)
- Agency Agreement—Local Authority, Landowner(s), Commercial enterprise (e.g., plantations), NGOs.
- Voluntary or "Social Duty" participation (e.g., for tertiary roads).

The role of planning and programming within road maintenance organisations needs to be carefully defined
and an appropriate organisational structure developed to:

- provide sufficient authority to effectively carry out the planning and monitoring functions;
- provide an adequate chain of responsibility and accountability.

There is some scope for private sector participation in planning and programming functions, for example, with respect to regular surveys to determine road conditions and maintenance needs.

**Resources**

Planning and monitoring functions cannot be carried out without funding. There are no guidelines available for assessing an appropriate budget or resource provision for these activities. However, in the rural highway construction sector, design and supervision of the works are typically 8% of the total cost of works. This ensures quantification and specification of works and completion to these requirements.

Discussion regarding appropriate allocations for PPM should be encouraged. A cost-benefit relationship of, for example, 5% of total maintenance costs allocated to PPM, to secure an increase in effective maintenance of 50% would be a very worthwhile investment. Specific personnel, accommodation, transport, equipment and budget allocations demonstrate the commitment to PPM and protect the function in times of overall funding cutbacks.

**Data Requirements**

Adequate data are required to support PPM functions. A number of PPM systems installed in recent years have been overly optimistic regarding the extent and accuracy of data that will be collected.

For a PPM system the guiding principles should be to:

- collect only the data essential to support important PPM decisions, at least initially;
- decide the extent of data collection for each item;
- determine the accuracy required;
- decide frequency of collection and updating required;
- decide the appropriate degree of mechanisation or sophistication of data collection, processing, storage and dissemination;
- review data collection capability and be realistic in estimating future capability; and
- consider the data requirements of other road maintenance functions.

The essential data required for effective PPM fall mainly into the following categories:

- Road Inventory and Condition: maintenance needs;
- Maintenance Resources: manpower, equipment and support, and materials;
- Maintenance Achievement and Productivities;
- Maintenance Unit Costs.

These data need apply to both Network and Operational Planning with different degrees of aggregation. The categories of data listed above are required to support policy and strategy development and decisions particularly in equipment management, appropriate use of available resources and technology, use of local contractors and consultants and staff.

**Systems**

Effective systems and procedures for planning, programming and monitoring need to be established, based on manual or computer-assisted systems. The main advantages of computer systems are the large amounts of data that can be processed, stored and easily accessed. However, the appropriate operational framework and the discipline of correct data collection and vetting are equally necessary for both computer and manual systems.

Computer systems require specialist technical support and spares and training of operators and users. There are dangers that hardware could suffer similar problems to road maintenance equipment unless adequate support systems are developed. Another potential pitfall is that, because the system is available, it will encourage additional demands. This can easily lead to overloading of the system. There should also be fall-back systems and procedures for the inevitable occasions when systems break down. Systems will invariably need to be tailored to dovetail with existing systems and procedures, regulations, organisation structure and responsibilities,
personnel resources and capabilities, and network and road maintenance characteristics.

Network planning has particular system requirements for the development of policies and plans. Some sort of modelling is normally required to carry out these functions. Various computer models exist, such as HDM III and RTIM 2. The options are to use these models as they stand, or to take components of these systems and tailor them to individual road authority requirements.

The PPM requirements of routine and periodic maintenance are somewhat different, and it may be appropriate to structure the systems to meet these different needs.

Routine maintenance is a more continuous need with a variety of operations required on a road section during each year. Periodic maintenance operations on the other hand are usually only required on a road section after a period of 5-10 years. Periodic maintenance needs can usually be predicted well in advance given appropriate pavement monitoring.

In terms of resources, routine maintenance operations are usually limited in extent and in resource requirements, whereas periodic resurfacing is usually required over a significant length of road and necessitates significant resource mobilisation.

There are two basic tasks involved in programming and deploying resources:

- Identification and quantification of maintenance needs, followed by application of priority guidelines to resource and funding constraints and identification of work that can be achieved and deployment of the resources to the worksites. This is the system typically used for equipment-based routine maintenance working from area road camps and for periodic resurfacing works.

- Allocation of resources to individual roads according to resource and funding constraints and overall maintenance needs assessment, followed by direction of operations, according to priorities. This is the system used by the Kenya Minor Roads Program using lengthsmen contractors for routine maintenance. The requirements and PPM systems necessary for these two options are very different.

Personnel

The provision of sufficiently trained and experienced personnel is a basic necessity for the implementation of planning, programming and monitoring functions.

Insufficient attention is normally given to the motivation and accountability of personnel. Efforts regarding the provision of adequate funding and resources will be wasted if maintenance personnel are not motivated to perform and if they are not accountable.

Perceptions of status, respect and authority to carry out duties have a significant bearing on the motivation of personnel at all levels. Remuneration is also a major influence. Public sector remuneration in many African countries is very poor and is becoming increasingly so. Serious consideration must be given to the provision of incomes commensurate with duties, status and personal needs. If managers are forced to supplement salaries to meet basic needs, their attentions will certainly be diverted from official duties to activities that will satisfy the income shortfall. This significantly affects management availability. Poor remuneration encourages personnel to fall back on their family, clan or tribe. As remuneration problems increase there will be a stronger case for a significant shift to private sector involvement with its greater scope for flexibility, motivation, and accountability. It is essential that these human factors be carefully considered when planning interventions to improve maintenance functions.

Policy Development

This section discusses the considerations which are relevant to the development of policy action plans or strategies for improving road maintenance performance. A review of current maintenance problems, capabilities, constraints and influences is an important first step to defining needs and developing a strategy to improve performance. Management tools such as Goal-Oriented Project Planning (GOPP) can provide a useful framework for achieving this, as well as formulating action plans and monitoring implementation. A case study presented with this paper describes the experience of the application of GOPP to the Kenya Minor Roads Program.

It is important to build as much as possible on existing systems, procedures and experience, to enhance or complement these systems, unless they have a detrimental effect.

It is important to limit data collection to information essential for important functions, at least initially. However, it is also important to design systems to accommodate possible developments in functions and data requirements.

The development of systems should be carried out with the involvement of the key personnel expected to contribute to and benefit from the system. It is impor-
tant that they be convinced of the benefits of new systems. Key personnel must be motivated to ensure that the system succeeds.

It will not be possible to improve all aspects of maintenance planning and management in the short term. It will be important to define priorities based on interventions that are likely to create the best increases in effectiveness given the constraints to be overcome.

Development of PPM systems should be carried out in a phased manner, ideally using a pilot phase or selective introduction to test assumptions and systems. Flexibility to adjust implementation in light of a review is important. Interventions should be realistic regarding the rate of progress achievable with respect to: required institutional changes; established methods, procedures and interests; personnel resources, training, skills and experience; and the ability to set and meet targets.

Training for personnel involved with all PPM functions will be an initial and ongoing requirement. The ongoing training will be essential to cover updating and refresher roles as well as personnel replacements due to retirements, promotions, transfers and resignations.
Objective Tree for Improved Road Maintenance

- Road Maintenance is Improved
- Higher Level Objective
- Other Improvements
- Physical Planning, Programming and Monitoring is Improved

Policy Objective

Figure 1

Framework for Action: Network Planning

- Road Maintenance is Improved
- Higher Level Objective
- Other Improvements
- Adequate Finances Mobilised
- Political and Public Awareness Improved
- Donor Coordination Satisfactory
- Improved Use of Local Resources and Private Sector
- Appropriate Policies
- Network Planning Improved
- Institutional Framework
- Resources
- Date
- Systems
- Manpower

Policy Action

Figure 2
Robert C. Petts: Road Maintenance Management and Operational Planning

**Figure 3: Annual Maintenance Cycle**

1. Establish and Quantify Maintenance Needs
2. Report Achievement
3. Consider Technology and Implementation Options
4. Cost Resource Requirements/Options
5. Prepare Draft Annual Plan within expected Budget and Resource Constraints, using Priority Guidelines
6. Prepare Budget Submission
7. Finalize Annual Plan on Notification of Funds Allocation
8. Monitor work output, Resources and costs
9. Compare to Plan
10. Prepare Draft Annual Plan within expected Budget and Resource (Initiate, Organise and Supervise works)
11. Programme Work (Weekly/Monthly)

**Figure 4: Framework for Action: Operational Planning, Programming and Monitoring**

- Road Maintenance is Improved
- Higher Level Objective
- Other Improvements
- Other Improvements
- Management of Financial Resources Improved
- Management of Physical Resources Improved
- Improved Use of Local Resources and Private Sector
- Accountability Improved
- Operational Planning, Programming and Monitoring Improved
- Policy Action
- Institutional Framework
- Resources
- Date
- Systems
- Manpower
Nearly one third of the highway network in Ethiopia was built before 1960, and some roads were built as early as 1930. It has been a policy to build comparatively weak pavements. At the same time, the legal axle load is low (eight tons per single axle) and generally disregarded. A comprehensive survey carried out some years ago indicated that axle loads of more than 13 tons were quite common. The combination of high axle loads and weak pavements has led to the rapid deterioration of pavements and to high maintenance costs.

In addition to the age of the road vehicles and traffic overloading, there are several other factors that have contributed to the poor condition of roads and deficiencies in maintenance standards. These factors include foreign exchange constraints on capital equipment and spare parts, shortage of personnel and sufficient operating budget, and lack of experienced staff to make effective use of management systems.

In Ethiopia, an important lesson drawn over a thirty-year period (1951-1980) was the importance of institutional development in the form of improving Management Systems. In this regard, the World Bank assisted the Ethiopian Road Authority to introduce several management systems—Maintenance Management System, Equipment Management System, and Financial Information System. The Maintenance Management System provides a rational process for developing the maintenance and includes an operational framework for scheduling, monitoring and evaluating maintenance operations. The introduction of the road Maintenance Management System (initially tested in a pilot area and later on implemented nationwide) has assisted managers to be efficient and cost effective in controlling various activities. The Fiscal Information/Maintenance interface has provided a consistent form of costing that provides reasonably reliable cost estimates.

Finally, the Equipment Management System provides asset control procedures (equipment classification, equipment identification, equipment inventory, rental recoveries, equipment disposal, equipment usage data and purchasing strategy), service support (e.g., preventive maintenance program, spare parts inventory control), data support (e.g., equipment reports), finance support, (budgets, revenues), equipment replacement strategy, and computerization of operational data.

In Ethiopia, an important lesson drawn over a thirty-year period (1951-1980) was the importance of institutional development in the form of improving Management Systems. In this regard, the World Bank assisted the Ethiopian Road Authority to introduce several management systems—Maintenance Management System, Equipment Management System, and Financial Information System. The Maintenance Management System provides a rational process for developing the maintenance and includes an operational framework for scheduling, monitoring and evaluating maintenance operations. The introduction of the road Maintenance Management System (initially tested in a pilot area and later on implemented nationwide) has assisted managers to be efficient and cost effective in controlling various activities. The Fiscal Information/Maintenance interface has provided a consistent form of costing that provides reasonably reliable cost estimates.

The success of modern Management Systems, however, depends to a great extent on the available human resources. Accordingly, sufficient staff must be provided at all levels to operate the Maintenance Management System. In Ethiopia, a continuous program has been launched to train staff who could carry the system through. Unfortunately, there has been a shortage of supervisory staff to monitor and evaluate work progress at the field level, and promote communication between the different levels of management involved in planning, organizing, directing and controlling the maintenance program. The system has, however, created a greater awareness of problems of road maintenance and has demonstrated the procedures and work methods useful in solving them.

Lack of maintenance equipment and spare parts has been a major problem in Ethiopia and no amount of management can compensate for the deficiency. This problem is likely to remain over the medium term, with foreign exchange availability being a major constraint on development activities in the country. Low availability of equipment will continue for some years to hinder better performance in road maintenance. Availability of key items of equipment (graders, asphalt distributors) is likely to remain less than 40% in the short term.
Introduction

The trunk roads in Ghana consist of 5,782 km of paved and 8,352 km of unpaved roads, making a total of 14,134 km. Most of the network was built before 1970, but subsequently suffered from serious neglect of maintenance. Today, about 40% of the trunk roads are in good condition and 30 percent in fair condition. Due to the inadequate maintenance in the past, a large backlog has built up that needs to be cleared urgently, in addition to carrying out the routine and periodic maintenance required each year. Until last year, periodic road maintenance covered only about 20% of the estimated annual needs. If this trend were to continue, almost a total collapse of road transport would inevitably result. A program to clear the backlog of maintenance must, of course, take into account the need to spread the investment over a reasonable period of time while simultaneously dealing with the continuing deterioration of roads during the plan period.

Traffic

Traffic on the trunk road network in Ghana is not very high. The average ADT is less than 1,000 vpd over 76% of the paved roads and less than 200 vpd over 78% of the unpaved network. On most sections, the medium and heavy truck traffic accounts for less than 30% of total volume and has equivalent standard axle load factors that range from about 1.5 to 3.0 which are not exceptionally high in comparison to those in other Sub-Saharan countries.

Pavement Strength

The pavement in most cases consists of 150 mm of gravel subbase, 150-200 mm of gravel base and either a single or double surface dressing or in a few cases, asphalt concrete surfacing. The subgrade strength as measured by the California Bearing Ratio (CBR), ranges from an average of 5% to 15%. In most cases, the pavement structural number (SN) varies from 1.5 to 3.0. The gravel roads design calls for a 150 to 200 mm of well compacted, good quality gravel surface. Yet, in many cases it has not been replenished in a long time.

Deterioration Cycle

It is estimated that with basic routine maintenance, including patching of potholes and timely repair of cracks and edge failures, a newly constructed paved road in Ghana can remain in good condition for about ten years; thereafter, in fair condition for another seven years, during which time it can be restored to good condition with a thin overlay or a surface reseal. If no periodic maintenance is performed during this time, the pavement will deteriorate into poor condition, at which time a total reconstruction or resurfacing of the pavement will be required to restore the road to good condition. On this basis, and assuming uniform age distribution of the roads, it is conjectured that about 1/10th of the paved roads in good condition will make the transition to fair condition each year, and about 1/7th of the roads in fair condition will move to poor condition during the same time. For gravel roads, the corresponding fractions are both assumed to be 1/7th.

Maintenance Requirements

Major rehabilitation of the badly deteriorated paved roads require, in most cases, complete reconstruction of the pavement, including some realignment and earthworks, and major repairs to drainage structures. This task is estimated to cost US$250,000 per km. To restore the remainder of the paved roads in poor condition, resurfacing of the pavement consisting of the addition of a new base course and a surface dressing will be required. In some cases, embankments may need to be raised or rebuilt together with minor shoulder repairs. The estimated cost for these activities varies from US$35,000 per km to US$65,000 per km. An average figure of US$50,000 per km is used here. Pavements that need to be restored from fair to good condition require only rescaling at an estimated cost of US$22,000 per km.

The major activity required on unpaved roads is regraveling of the surface. However, depending on whether the road is in fair or poor condition and on the degree of deterioration, different amounts of repairs of the shoulders and road formation will be required. For simplicity, the average cost of regraveling, including repairs, is taken as US$7,000 per km.

Network Stabilization Plan

The optimal mix of road conditions in the entire network can only be determined on the basis of minimizing total transport costs, i.e., the sum of maintenance and vehicle operating costs plus any new construction costs. Even if funds are unlimited, it is not necessarily optimal to keep 100% of the network in good condition at all times. Studies in other countries have shown, for example, the periodic resurfacing on the very low volume paved roads (with ADT less than about 150 vpd) is difficult to justify economically, particularly under budget constraints.

Such roads warrant only routine maintenance, including patching of potholes and sealing of cracks until such time as the traffic increases sufficiently to justify pavement reconstruction. Data was not available at the time to determine the optimal condition mix for the trunk road network in Ghana.

Therefore, in the interim, a desirable mix consisting of about 9,600 km in good condition, 3,000 km in fair condition and 1,500 km in poor condition, was stipulated, with a breakdown by paved and unpaved roads as shown in Table 1.

Table 1: DESIRABLE CONDITION MIX OF THE NETWORK

<table>
<thead>
<tr>
<th>Road Type</th>
<th>Unit</th>
<th>Good</th>
<th>Fair</th>
<th>Poor</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paved</td>
<td>km</td>
<td>4,282</td>
<td>1,000</td>
<td>500</td>
<td>5,782</td>
</tr>
<tr>
<td>%</td>
<td></td>
<td>74</td>
<td>17</td>
<td>9</td>
<td>100</td>
</tr>
<tr>
<td>Unpaved (Gravel)</td>
<td>km</td>
<td>5,352</td>
<td>2,000</td>
<td>1,000</td>
<td>8,352</td>
</tr>
<tr>
<td>%</td>
<td></td>
<td>64</td>
<td>24</td>
<td>12</td>
<td>100</td>
</tr>
<tr>
<td>Total Network</td>
<td>km</td>
<td>9,634</td>
<td>3,000</td>
<td>1,500</td>
<td>14,134</td>
</tr>
<tr>
<td>%</td>
<td></td>
<td>68</td>
<td>21</td>
<td>11</td>
<td>100</td>
</tr>
</tbody>
</table>

Seven-Year Stabilization Program

Table 2 shows the seven-year stabilization program derived in this manner, except that in order to fit the physical output to the budget requirements, and to build up the major rehabilitation program slowly over the next seven years, it was necessary to alter the intermediate target lengths in some years.

Under the plan shown, the gravel road network will stabilize in five years. The periodic maintenance needs on the paved network will stabilize in seven years, during which time the backlog requiring major rehabilitation will also be cleared. As seen from Table 2, the program requires 918 km of regraveling in 1988, rising to 1,224 km in 1992, and stabilizing thereafter to 765 km per annum. As more and more roads are added into the good condition category, resealing needs will increase steadily from 50 km in 1988 to 285 km in 1995 and thereafter, while resurfacing needs will decrease from 409 km in 1988 to 83 km in 1995 and thereafter. Major rehabilitation and strengthening of the badly deteriorated roads is planned to increase from 150 and 60 km annually thereafter.

The periodic maintenance expenditure in the first five years amounts to US$28 m per annum, decreasing to US$18.8 m over the next two years, before stabilizing at US$15.8 m per annum thereafter. Funds required for major rehabilitation increase gradually from US$37.5 m in 1988 to US$67.5 m in 1992, falling off to US$55.5 m in 1994 and to US$15 m per annum thereafter.

The fraction of the combined network that is in good condition increases steadily from about 30% to about 70% at the end of the plan period and is kept at that level with funds that are well within the existing maintenance budget. During the same period, the fraction of roads in poor condition decreases from about 40% to about 10% and the fraction in fair condition decreases from 30% to about 20%.

If funds are not made available to embark upon the accelerated program of clearing the backlog as
stipulated here, then it can be shown that with only the current committed level of funding (approximately US$16 m for periodic maintenance and US$25 m for major rehabilitation), it would take about 20 to 30 years to accomplish the same task of stabilizing the network to the desired condition mix.

Funding

The program, as derived above, called for almost a two- to three-fold increase in the annual budget allocation for periodic maintenance of trunk roads made in the past to the Ghana Highways Authority. However, the Government has, since 1987, committed itself to increase the annual funding for periodic maintenance by almost 50% to approximately $16 m per annum. This would be sufficient to cope with the requirements after the backlog has been cleared and the network condition stabilized. Meanwhile, external financing will continue to be required to clear the backlog under the accelerated program.

Conclusion

Ghana has developed a practical program for clearing the backlog of road maintenance and preventing further loss of the valuable investments in its road infrastructure. The program is developed in such a way that the backlog of maintenance will be cleared on the gravel roads in five years and on the paved network in seven years. The fraction of the network in good condition will improve from about 30% to 70% while at the same time the fraction in poor condition will reduce from 40% to about 10% in seven years. The maintenance expenditure required thereafter will stabilize to manageable levels annually to maintain the network at the desirable condition level. The key elements of the program that have made it successful so far may be identified as follows:

- The program is spread over a realistic time period and takes into account the continuing deterioration of the roads during this period.

- While the funds required for implementing the program are greater than past allocations under government budget, they are not unrealistically high for external financing. In addition, the plan is accompanied by a doubling of local funds and a commitment by government to leave the project intact in its current and future public investment programs.

- The project is being closely monitored and supervised by the Ghana Highway Authority with the assistance of local and foreign consultants.
<table>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1988</td>
<td>Starting Position</td>
<td>1,593</td>
<td>1,236</td>
<td>2,953</td>
<td>2,672</td>
<td>2,989</td>
<td>2,691</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Percent Distribution(%)</td>
<td>28</td>
<td>21</td>
<td>51</td>
<td>32</td>
<td>36</td>
<td>32</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1989</td>
<td>Without 1988 M&amp;R Prog.</td>
<td>1,434</td>
<td>1,219</td>
<td>3,130</td>
<td>2,290</td>
<td>2,944</td>
<td>3,118</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1988</td>
<td>Expected M&amp;R Prog.</td>
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<td>-50</td>
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<td>918</td>
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<td>2,571</td>
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<td>38</td>
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<td>1,839</td>
<td>1,206</td>
<td>2,738</td>
<td>2,750</td>
<td>2,851</td>
<td>2,752</td>
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<td>-375</td>
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<td>994</td>
<td>-257</td>
<td>-737</td>
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<td>1,102</td>
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<td>1990</td>
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<td>710</td>
<td>-160</td>
<td>-330</td>
<td>-220</td>
<td>1,071</td>
<td>-361</td>
<td>-710</td>
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<td>-160</td>
<td>-330</td>
<td>-220</td>
<td>1,071</td>
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<td>-710</td>
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<td>26</td>
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<td>-270</td>
<td>1,224</td>
<td>-572</td>
<td>-652</td>
<td>28.0</td>
<td>67.0</td>
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<tr>
<td>1993</td>
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<td>1,006</td>
<td>5,352</td>
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<td>Percent Distribution(%)</td>
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<td>24</td>
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<tr>
<td>1994</td>
<td>Without 1993 M&amp;R Prog.</td>
<td>3,399</td>
<td>1,235</td>
<td>1,149</td>
<td>4,587</td>
<td>2,479</td>
<td>1,286</td>
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<td>-165</td>
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<td>-479</td>
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<td>1,262</td>
<td>876</td>
<td>4,587</td>
<td>2,479</td>
<td>1,286</td>
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<td></td>
<td></td>
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<tr>
<td>1994</td>
<td>Expected M&amp;R Prog.</td>
<td>637</td>
<td>-262</td>
<td>-153</td>
<td>-222</td>
<td>765</td>
<td>-479</td>
<td>-286</td>
<td>28.0</td>
<td>55.5</td>
</tr>
<tr>
<td>1995</td>
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<td>501</td>
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<td>1,000</td>
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<td>Percent Distribution(%)</td>
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<tr>
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<td>Without 1995 M&amp;R Prog.</td>
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<td>1,285</td>
<td>644</td>
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<td>2,479</td>
<td>1,286</td>
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<td>Expected M&amp;R Prog.</td>
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<td>-479</td>
<td>-286</td>
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<tr>
<td>1996</td>
<td>With 1995 M&amp;R Prog.</td>
<td>4,281</td>
<td>1,000</td>
<td>501</td>
<td>5,352</td>
<td>2,000</td>
<td>1,000</td>
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<td>12</td>
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<tr>
<td>1996</td>
<td>Expected M&amp;R Prog.</td>
<td>428</td>
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<td>765</td>
<td>-479</td>
<td>-286</td>
<td>15.8</td>
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Table 2: NETWORK STABILIZATION PLAN (1988-1995) AND PROJECTED ROAD CONDITIONS
Overview

Road transport in Kenya is one of the main surface modes of transport. Essentially, it is the most important mode of transport. It has been developed over the years, from the tracks and trails that were used by traders and travellers between the hinterland and the coast, to the present tarmac highways of today. With the advent of the Kenya-Uganda Railway in the early 1900s, tracks formed the main access to the line, and with time, particularly after independence, the promotion of road transport, through the improvement of the tracks and trails to all weather roads has been a major objective of the Government of Kenya.

Kenya's road network comprises some 160,000 km of roads ranging from bitumen surfaced roads to earth roads. Of the 160,000 km, 63,000 km are classified while the rest (97,000 km) are unclassified. The latter comprises earth tracks that are either maintained by the county councils or unmaintained, although they allow the passage of traffic during the dry weather.

The classified road network which comprises 63,000 km is essentially the responsibility of the central Government and in particular the Roads Department of the Ministry of Public Works insofar as its planning, construction and maintenance is concerned. The network is grouped into seven categories which are based on the service given and not on the traffic or the surface type.

On July 1, 1983, the Government of Kenya initiated a policy in which the responsibility of the planning and implementation of rural development was shifted from the Headquarters of Ministries to the Districts. This strategy is known as the "District Focus for Rural Development" and is based on the principle of a complementary relationship between the Ministries in their sectorial approach to development and the districts with integrated approach to local needs.

Each district has a District Development Committee which is the foundation of the decentralized rural development strategy. It comprises technical personnel from various ministries, the political members of Parliament and representatives of local and non-governmental development related organizations. Its Chairman is the District Commissioner.

Through this committee the roads implemented under the Minor Roads Program are planned, selected and implemented.

Mobilization and Management of Financial Resources

The Rural Access Roads Program was initiated in 1974, and it aimed at providing farm to market access in twenty-three highly populous and agriculturally potential districts in Kenya.

Its aims and objectives included:

- creation of meaningful employment in the rural areas through the use of labor-based methods in road construction;
- provision of all weather access to markets, farms and social centers;
- raising agricultural production and/or diversity in agricultural techniques from subsistence to cash crops;
- raising the standard of living of the rural population.

To achieve the above objectives there was a need to mobilize both financial and human resources.

Several donors contributed to the implementation of the program, including SIDA, USAID, World Bank, NORAD, DANIDA, Netherlands, ODA (UK), CIDA, SDC, and ILO. The Government of Kenya contributed mainly the infrastructural and human resources required for the program. At the end of the implementation phase a total of 8,000 km had been built.

In the current improvement-based program of minor roads, 4,500 km of tertiary roads in the rural areas are expected to be improved. The following donors are participating in this effort: NORAD, SIDA, CIDA, Netherlands, DANIDA, SDC, EEC and ILO. The financial component is mainly in grant form amounting to 80% of the total budget estimated at K 865 million over a five-year period.

* Author: B. G. Ariga is Senior Superintendent Engineer with Kenya's Rural Roads Access Programme.
Management of Physical Resources

The physical resources for the implementation of the program include mainly equipment and the office infrastructures. Each district has supervisory vehicles (Land Rovers and motorcycles), trucks for haulage of construction materials, tractortrailers for haulage of gravel, water and fuel bowers for storage of water and fuel respectively.

To facilitate the maintenance of these vital pieces of equipment, each district is equipped with a standard workshop and essential tools. Each district is in turn supported by a Regional Workshop headed by a Regional Mechanic.

Donor Coordination

The Minor Roads Program is a multi-donor funded project. Coordinating the activities of all the donors involves an annual meeting and is held between the Government of Kenya and the donors. These annual donors review and evaluation meetings are coordinated under the auspices of the International Labor Organization. The participants on the donors' side are mainly representatives from the donors' headquarters and Nairobi.

To monitor the progress of the project on a continuous basis, several mini-donor meetings are held between the Government of Kenya and the locally based donor representatives. These are coordinated by the Nairobi based ILO representative.

To supplement the resources of the Government of Kenya, local private contractors and suppliers are sometimes called upon to participate in the program’s activities, such as, graveling of roads with long haulages, supply of local tools and construction materials, and supply of equipments, spares and repairs.

Use of Local Resources

In an effort to find extra local resources for the maintenance of roads, the government, in 1984, enacted an Act of Parliament known as the "Public Road Toll Act" to provide for the collection of tolls on specific public roads. The Toll Fund was to supplement the allocations from the Treasury. About 8-No. out of the gazetted 15-No. toll stations are already operational in the country. During the 1987/88 fiscal year, a total of Kshs. 114 million was collected.

The Government of Kenya has instituted the axle load control program in order to curb the premature failure of pavements which takes place due to the overloading of the pavement by overloaded vehicles.

In addition the transportation of bulk goods on roads is being discouraged in favor of the rail system which is more efficient for this type of load. An oil pipeline has been built from Mobasa to Nairobi and is proposed for extension to Western Kenya in an effort to reduce the overloading burden on the road network.

The use of gravel or murram as a road surface material is second to bitumen in the provision of all weather roads. About a third of the road network is gravel standard. The gravel is normally applied to newly improved earth roads to, or close to, engineered standard. It is also used in the regravelling of roads, which normally has an average cycle period of 4-5 years. With the continued increase in land use for agriculture, coupled with enormous requirements for gravel, there is a general feeling that the existing gravel sources are on the decline, and the Ministry has sought the use of other materials and/or the preservation of the gravel surface, in order to meet all weather roads needs. In particular, the Ministry is investigating the use of oil seals on compacted gravel surfaces particularly on low volume roads. It is hoped that in due course, the Ministry will devise ways and means to reduce the gravel requirements. This will reduce the need for maintenance operations related to regravelling thereby safe on gravel and associated costs.

All road construction and maintenance activities can be undertaken by labor with limited equipment support as has been proved under the Rural Access/Minor Roads Program. In a developing country like Kenya, where equipment, spares and fuel have to be procured outside the country, draining the scarce foreign exchange, the choice in the use of labor based methods becomes an applaudable proposition. It is in this respect that the long-term objective of the Minor Roads Program is to develop further labor intensive techniques in roads construction and maintenance. This will ensure the use of the local resources of labor, effectively and efficiently.

Normal road construction activities are carried out by workers using simple tools. Gravelling of the roads is undertaken using tractors and trailers for haulage, while excavation, loading, unloading and spreading are carried out by the workers.

Contracted lengthpersons maintain the roads using simple handtools. They carry out routine and urgent maintenance. Periodic maintenance, entailing regravelling is carried out in similar manner to gravelling, but on a limited scale.
The Ministry is carrying out a study to determine the productivity of lengthpersons to arrive at reasonable lengths that each can adequately maintain.

Advantages in the use of the local resources of labor include:

- savings in scarce foreign exchange;
- reduction in recurrent costs related to accommodation and transport;
- local involvement in the project creates interest and initiative;
- workers have the social benefit of being with their families; and
- creation of meaningful employment.

Internal Accountability, Incentives and Staff Motivation

The Minor Roads Program is managed by the Ministry of Public Works within the Roads Department. It is regulated under the service regulations governing the Kenya civil service. The latter entails built-in internal accountability in terms of finance, physical output, discipline etc.

For all permanent staff within the program, a scheme of service stipulating the available promotional opportunities exists and is applicable.

For the economy and success of a labor-based construction program, it has been found that high labor productivity is fundamental. To ensure this high productivity, certain management systems have been instituted to provide incentive schemes to motivate the workers. These are:

- Daily pay: a worker is paid an agreed sum of money each day in return for working a fixed number of hours.
- Piece work: workers are paid a sum of money per unit output; the daily output is left to the discretion of the site supervisor.

- Task work: a worker is paid a fixed daily wage in return for a fixed quantity of work.
- Prompt payment of wages: besides fixing a wage rate which will attract a labor force, and is commensurate to production, the other most important motivation of the workers is to pay them on time; nothing else lowers the morale of the workers as much as delayed payment. To this end, the program ensures prompt payments to workers.

Developing Managerial and Technical Skills

Utilization of labor-based methods for road construction and maintenance is a developing technology. To this end the Ministry of Public Works has established ways of tackling the issues pertaining to the development of this technology, which includes the establishment of a Technology Unit and a Minor Roads Training School.

A Technology Unit has been established to investigate various technical and organizational aspects of the Minor Roads Program and also to coordinate the studies being undertaken by consultants. The results of the work of the Unit will be disseminated in the Program through the revision of the Technical Manual, courses and seminars.

The Minor Roads Training School is geared mainly to the training and retraining of the personnel in the Minor Roads Program in aspects related to the enhancement of labor based methods. It offers both theoretical and practical courses and operates construction and maintenance sites for personnel. As of April 1989, the school will extend the use of its facilities to the training of personnel in the rest of the Roads Department.

To enhance the management skills of senior personnel, the ministry, in conjunction with donors, has been organizing workshops based on GOPP—Goal-Oriented Project Planning. Two such workshops have been held to date; a third is planned for May 1989. In addition to these workshops, personnel within the Ministry have been attending short seminars and courses inside and outside the country. The Management and Reporting System is now being computerized to facilitate the program’s planning and monitoring.
Kenya: Minor Roads Programme Maintenance System - Case Study

Endnotes

Introduction

Policy action planning and project action planning are both carried out with the aim of improving/solving a problem area. This involves the analysis of the problem in the sector considered. Out of the analysis, expedient objectives are identified, strategies devised and steps and measures planned for producing the expected improvements. From the methodological point of view, the same planning tools can be adopted both for project and policy action planning. A very effective tool for project planning is the "Goal-Oriented Project Planning" (GOPP) method, which was used on the Kenyan Minor Roads Program (KMRP). The goal of the KMRP is to improve the maintenance of some selected 12,000 km of rural and minor roads in Kenya by developing and implementing a sustainable maintenance system. GOPP was used for the 1988 annual Donors and Government of Kenya KMRP review meeting. GOPP enabled the requirements and views of the Kenyan Government and seven donor agencies to be coordinated and action plans to be jointly developed for future program implementation.

Overview

With GOPP, a planning team agrees on a central problem for a situation: the so-called "core problem". Causes and effects of the core problem are explored and their interrelationship graphically represented in the form of a chart: the so-called "problem tree". Figure 1 shows the problem tree for the KMRP. Using the GOPP method, the problem tree is turned into a corresponding "Objectives Tree" by turning each problem into a corresponding objective. Figure 2 shows the objectives tree for the KMRP. Not all the problems can be solved within the scope of a project and that is why in Figure 2 several problems have not been turned into objectives. These remaining problems, which lie outside the project scope, represent risks of failure affecting the project. Therefore these risks have to be evaluated by the planning team and the corresponding assumptions stated in the project design. Figure 3 now shows the objectives of the KMRP and the assumptions now incorporated in the planning. The influence of these assumptions will have to be monitored by the project management during implementation. If a problem, external to the project, corresponding to an assumption worsens over time, the project should either be discontinued or extended in scope to include the solution of the problem with the support of higher political authorities. The risks bound with the assumptions may very often reduce the effectiveness of the projects and developmental impact (sustainability). A project designed with policy action planning is likely to have more of an impact. Figure 4 shows possible policy action planning for improving Rural and Minor Roads maintenance in Kenya. With the goal of "improving Rural and Minor Roads maintenance"(see Figure 4: Goal), five policy objectives should be considered and weighted. Options for achieving the policy objectives should be identified and implemented through suitable activities to the extent deemed necessary. Problems and objectives could be clarified by a planning team using GOPP and could be presented to the political authority for approval. In the proposed policy action planning, the KMRP objectives are still valid, because the program can achieve the policy objective of “improving efficiency of maintenance operations”(see Figure 4), but other activities related to the other four policy objectives should be implemented. By following this policy approach, action effectiveness would be increased as well as the developmental impact. When following a narrow project-based approach to solve a sector’s problems, the efficiency of projects can be high, but the cumulative influence of problems outside the project scope are likely to dramatically reduce its effectiveness, impact and sustainability.

Conclusions

Goal-Oriented Project Planning is a very effective problem-solving and action-planning tool. It is very well suited for both policy action planning and Project action planning. It has proved very valuable in the context of the KMRP, allowing the Ministry and seven donors to:

- agree on the prioritization of objectives and on the implementation of phased strategies;
- prepare a jointly agreed action plan and basis for monitoring for further implementation of the KMRP;
- be aware of and jointly evaluate risks affecting the program;
- be aware of and tackle long-term issues related to program effectiveness and sustainability.

GOPP as a valuable problem-solving and planning tool creates transparency for the problem area. It can be advantageous when used for project planning, increasing efficiency and optimizing effectiveness and impact under the given circumstances, but it can also be used for policy action planning, increasing effectiveness and the impact of any following action.

Figure 1: PROBLEM TREE FOR THE KMRP

A core problem is agreed upon by the planning team ("KMRP efficiency is too low") and the cause-effect relationships of the core problem are explored and graphically represented.

_Dotted lines_ link problems which cannot be solved by the KMRP-management and require higher authority's decision.
Figure 2: OBJECTIVES TREE FOR THE KMRP

The objectives tree is obtained from the problem tree, turning problems into objectives for their solution/improvement. The graphical representation indicates the means-to-end relationships among objectives.

Problems which cannot be solved by the KMRP remain problems, representing risks for the achievement of the program's objectives, and they will have to be evaluated by the planning team. These remaining problems/risks are represented in rectangular shapes linked by dotted lines to the objectives tree. In the figure, activities are identified to produce outputs which would achieve the project planning objective: "KMRP efficiency is improved."

The project planning objective would contribute to the goal: "Maintenance of rural and minor roads is improved."
Introduction

Most of the road network in Malawi was constructed in the early 1960s. Ever since there has been a continuing program of new road construction, reconstruction of aging sections of the network that have come to the end of their useful life and are no longer in serviceable condition, upgrading of road sections from earth to gravel and from gravel to bitumen standards. The designated road network as of 1986 (excluding the road network in municipal areas.) is as follows:

<table>
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<th>ROAD TYPE</th>
<th>Main (M)</th>
<th>Secondary (S)</th>
<th>District (D)</th>
<th>Branch (B)</th>
<th>Estate (E)</th>
<th>U</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bitumen</td>
<td>1812 km</td>
<td>260 km</td>
<td>24 km</td>
<td>0 km</td>
<td>8 km</td>
<td>73 km</td>
<td>2177 km</td>
</tr>
<tr>
<td>Gravel</td>
<td>127 km</td>
<td>149 km</td>
<td>16 km</td>
<td>0 km</td>
<td>0 km</td>
<td>0 km</td>
<td>291 km</td>
</tr>
<tr>
<td>Earth</td>
<td>733 km</td>
<td>2333 km</td>
<td>5316 km</td>
<td>136 km</td>
<td>108 km</td>
<td>335 km</td>
<td>8961 km</td>
</tr>
<tr>
<td>TOTAL</td>
<td>2672 km</td>
<td>2742 km</td>
<td>5356 km</td>
<td>136 km</td>
<td>116 km</td>
<td>408 km</td>
<td>11429 km</td>
</tr>
</tbody>
</table>

There has been a rapid expansion in Malawi’s rural economy. With the recent construction of road links to neighboring countries and the loss of railway links to the seaports of Nacala and Beira in Mozambique, Malawi relies more on road transport for the movement of its goods both internally and for exports and imports. The need to keep the road network adequately maintained is, therefore, of utmost importance to the country’s economy. To implement an effective road maintenance and rehabilitation program, it was essential to have an organized system for planning, controlling, and monitoring the road maintenance and rehabilitation program. It is for this reason that the Maintenance and Rehabilitation Management System (MARMS), a tool for the proper management of the road maintenance program for the nation’s main road network system was implemented in 1984 to improve, rather than replace the existing practice. Earlier the District Road Improvement and Maintenance Program (DRIMP) was introduced for the rehabilitation and maintenance of the district road network that is vital for communication in the rural areas of the country.

Central government (through the Ministry of Works) is responsible for the maintenance of the designated Main (M), Secondary (S), and a few important District (D) and undesignated (U) roads. Local government through the district councils is responsible for the maintenance of the designated District (D) road network. The rest of the network is maintained by other organizations or by the government on an agency basis.

The current road designation was done in the 1960s. Since then there has been an increase in traffic levels on most parts of the road network. The road designation has been reviewed to take into account changes in the function and importance and act as a guideline for setting priorities for the ongoing national road development program.

The Maintenance and Rehabilitation Management System (MARMS)

On a construction project, with well defined activities, project network techniques are used to develop a logical approach to planning, organizing, scheduling, controlling, and evaluating the progress of the project, as well as the level of expenditure at every stage of the project. It is difficult, if not impossible, to use such techniques for maintenance work since the activities involved are clearly not as well defined, and the work load is usually demand-driven. Maintenance work load responds to changing factors that contribute to the deterioration of the condition of a road, the weather, traffic volumes, axle loading, and indeed road maintenance practice, just to mention a few. MARMS provides managers a tool to manage routine maintenance and rehabilitation works. The objective of implementing MARMS in the Malawi’s Roads Department of the Ministry of Works

* Prepared by Mr. E.H. Msolomba, Malawi’s Deputy Controller of Roads (Construction and Maintenance).
was to provide managers with a tool that would assist them in providing an efficient and effective road maintenance program. MARMS is the basis for:

- achieving a uniform level of maintenance of roads throughout the country;
- preparing an annual work program based on priorities identified from maintenance feature and/or condition inventories and the level of service to be provided as determined by policymakers;
- efficiently allocating resources, i.e., labor, materials, and equipment needed to perform the annual work program;
- preparing a performance-based budget to support the annual work program;
- scheduling, authorizing, and performing work in accordance with methods and procedures designed to ensure optimum efficiency;
- reporting work performance in ways that permit management to effectively control and evaluate maintenance work program and operations; and
- improving in communication between all responsible for the management of the road maintenance program.

The steps involved in MARMS are as follows:

**Maintenance feature and condition inventory.** Maintenance feature and condition inventories are conducted twice a year by district road supervisors. The purpose of these inventories are twofold: to use and to prepare the work program for the following year, and to update and revise the work program in between the planning period. The procedure was made very simple so as to make it possible for each road supervisor to conduct an inventory for the network for which he is responsible.

**Performance Standards.** The performance standards in use were prepared in conjunction with the road supervisors. The objective was to standardize methods of performing work activities. The performance standards outline the work method to be used, the standard resource requirements for a standard crew, the expected daily production, and performance criteria for each activity. The standards are updated at headquarters after past performance reports have been studied or when a more efficient method of carrying out an activity has been identified.

**Setting service levels.** Service levels are set at headquarters, normally to maintain the level of maintenance service provided during the most recent period (if the level of service was acceptable) or set a new level if what was achieved during the previous period was too high or not acceptable.

**Annual Work Load, Work Program and Budget.** Annual work programs for each district by road type are prepared from the inventory data collected from the districts, the performance standards, and the set service levels. The district totals are summed to form regional budgets, and regional budgets are further summed to form the national road maintenance budget. The budget requests (combined with budget requests for other sections within the roads department) are then presented to the Treasury. If funds are allocated as requested, there are no adjustments made to the work program. However, if fewer funds than requested to fulfill the planned program are allocated, there will be a need to make adjustments to the work program either by reducing the level of maintenance service to be provided on all or some activities on part of or the whole network, or by reducing the amount of inventory units on which the work would be performed, or both. Consideration would have to be given to the relative importance of activities and sections of the network on which service levels will be reduced). When the work program is approved and funds are allocated to the regions each district supervisor is sanctioned with funds to enable him to carry out the work on his program for each period.

The district supervisors then schedule and authorize work as per the agreed program. Work is scheduled on a fortnightly basis taking into account work priorities as identified during inspection trips. The work accomplished is reported to the region using reporting forms. The report contains information for each activity, resources used, where on the road network the work was done, and the work accomplished. This information is recorded into a data management system at the regional headquarters and performance and evaluation reports are prepared and distributed to district, regional and headquarters managers to use for control and evaluation purposes. The MARMS flow Chart shows how the system operates (See Annex 2).

**Management and Policy Issues Addressed by MARMS**

The implementation of MARMS in the Roads Department of the Ministry of Works has allowed the government to address several important management and policy issues that have contributed to a more effective and efficient maintenance and rehabilitation program for the road network in the country.

MARMS has assisted management in identifying in detail the maintenance work load for each management unit. The work load is broken down into activity levels
for each management unit. This has made it possible to set and measure performance for the road maintenance effort and also to measure the effectiveness of the road maintenance efforts for each management unit and eventually for the department.

Through the reorganization of road maintenance districts and zones in setting up the management system, it has become easier to identify road maintenance supervisory personnel, and basic camp and equipment requirements. It was, therefore, easier to identify training needs for staff development, and to continue training for serving staff to improve their technical and managerial skills. Equipment is a major input in road maintenance programs. Unavailability of equipment in serviceable conditions or simply the lack of an adequate supply of a particular piece of equipment has, in the past, resulted in delayed and often more costly completion, or in the extreme case, failure to complete a maintenance program. With the management system, planning for the availability of equipment at the right place at the right time is made easy. Sometimes programs have been delayed due to the unavailability of materials in sufficient quantities when required. This, too, results in unnecessary and costly delays sometimes resulting from a lack of adequate forward planning. The MARMS help managers to identify the material requirements to fulfill the work programmed for each period. If some materials need advance ordering, managers are made aware of this requirement and can press for orders in advance to ensure delivery in time for the activity for which the materials are required. Sometimes because of financial constraints, programs have been delayed. Sometimes efforts to catch up with the program following late issue of funds have resulted in poor work quality and a more expensive program because of increased overheads as a result of having to keep people and equipment idle. The system makes it possible for management to identify cash requirements for each period and so plan for the adequate provision of funds in advance. In cases when funds are delayed the system allows management to adjust the program so as to reduce the effects of the delay in the allocation of financial resources, or when it is obvious that delays in allocation of funds are inevitable, advise the financing agencies of the expected adverse effects.

The budgets prepared by the system are based on the work load estimated by taking inventories, work required to achieve a set level of maintenance service, and a set performance standard. Unless the factors that contribute to the deterioration of the road condition change drastically during a planning period, the planned budget estimates are close to the actual requirements. To ensure that the agreed budgets are not exceeded for no good reason, the work progress is controlled by performance reports which are submitted at agreed intervals. In addition a contractor-client relationship was established between the regional offices and headquarters whereby funds are allocated quarterly for work programmed for each quarter. At the end of the quarter a meeting is arranged to evaluate the performance for the period. Any major divergence from the plan either in work performance or level of expenditure is accounted for. The issue of funds for the following quarter is made taking into account any savings, over expenditures, and revision to the program that are necessary.

The implementation of the management system in the maintenance section of the roads department has assisted in clarifying the objectives of each management unit. Prior to the introduction of the system most of the planning for work was done by the regional managers. The district road supervisors were agents for carrying out maintenance work as instructed. The district road supervisors are now responsible for planning for maintenance work in their district. They are now accountable financially and for work performance. There is an improvement in management skills at the district level as a result of the increased responsibility and training provided. The district supervisors and the zone road foremen are more aware of the costs involved in carrying out various maintenance activities. As a result there is more thought given to planning and scheduling maintenance work at the district level in order to reduce costs. Comparison of work performance between districts has aroused the spirit of competition, and each supervisor has the incentive to perform as well or better than others doing similar work. The district supervisors have to make their own work schedules based on work priorities as identified during field inspection trips. The decentralized short-term planning for maintenance work in the districts (previously done by regional managers, now the responsibility of the district supervisors) and the availability of more detailed monitoring capability, through performance reports, has relieved the regional managers of some of their former responsibilities. They can now concentrate their efforts on control and evaluation and planning for the long term.

Management of Periodic Maintenance and Rehabilitation Work

Routine maintenance work is done by direct labor through the regional controller of works establishments. Periodic maintenance and rehabilitation work is contracted out most of the time. The ministry still maintains Road Construction Units (RCUS) which carry out some of the rehabilitation projects. Manual methods similar to MARMS are used to manage rehabilitation works done by these in-house construction units. There are reasons for the allocation of some of the rehabilitation works to the RCUS. The RCUS are used for training engineers and technicians. They are readily available to respond to emergencies. The activity unit costs achieved by these units form the basis for
The road department management structure was reorganized to provide a structure with additional staff to take responsibility of planning, control and evaluation for maintenance, rehabilitation, and new construction programs. The main changes were:

- the formation of the maintenance and construction division at headquarters level.
- the merging the Roads and Design Departments into one department.
- the formation of the Road Planning Unit within the Design and Planning Unit.
- the establishment of individual units within each division to be responsible for planning and monitoring.
- the establishment of a Mechanical Engineer’s section to take responsibility for the provision and implementation of a preventive maintenance program for the department’s basic equipment fleet.

The Organization Structure - Roads Department

The diagram shows the organization structure of the Roads Department in Malawi, including the roles and responsibilities of various departments and sections. The structure is hierarchical, with the Secretary for Works at the top, followed by the Commissioner for Works, and then the Regional Controllers of Works (3 No., Regions).

Notes:
- COR = Controller of Roads
- CCE = Chief Civil Engineer
- ACCE = Assistant Chief Civil Engineer
- PCE = Principal Civil Engineer
- PME = Principal Mechanical Engineer

The diagram includes the Planning and Design (Deputy COR), Construction and Maintenance (Deputy COR), Maintenance Branch (CCE), and other branches and sections such as the Roads Planning Branch (CCE), Design and Contracts Documents Branch (CCE), Soils and Materials Branch (ACCE), and more.
MINISTRY OF WORKS AND SUPPLIES
Roads Department

MAINTENANCE and REHABILITATION MANAGEMENT SYSTEM

1. WORK PLANNING

2. WORK PROGRAMME DEVELOPMENT

3. WORK AUTHORIZATION

4. WORK SCHEDULE

5. WORK PERFORMANCE AND REPORTING

6. WORK EVALUATION AND CONTROL

7. SYSTEM MODIFICATION AND IMPROVEMENT

MAINTENANCE MANAGEMENT INFORMATION FLOW CHART
Niger is a landlocked country in West Africa that extends from the northern fringe of a rain-fed agricultural region into the heart of the Sahara desert. Nearly 90% of its six million population is concentrated along the southern border in the 12% of the land that is arable. Niger is one of the poorest countries in the world with a per capita GNP of about US$200, and an economy dominated by subsistence agriculture. Adequate transportation is critical to Niger. Large stretches of nearly empty land exist between population centers. High transportation costs limit the competitiveness of Niger's products on the world market, make imported items expensive, and add to the cost of delivering services to distant urban centers and the scattered rural population.

The road network in Niger is 9,800 km long; 3,160 km of the roads are paved. Traffic volumes are low; outside urban areas, the highest traffic volume is less than 1,000 vpd, and only 546 km (17% of the paved roads) carry more than 300 vpd.

The road network is relatively new; the first one-lane paved roads were built in the 1960s. In the 1970s, all of these roads were widened to two lanes. A two-lane standard is now employed throughout the network. The paved roads are therefore at a point at which extensive periodic maintenance is required for the first time. The Public Works Department (PWD) grew into existence over the same twenty-five year period. The Ministry of Public Works realized that a rational system was needed to develop a maintenance program to safeguard investment in the road system. However, this system would have to be tailored to Niger, a poor country with a sparse but expansive road network and an extremely limited number of engineers and technicians.

A Road Management Unit (RMU) was therefore established in the PWD with two objectives: to monitor the condition of the network and the volume of traffic using it, and to develop periodic maintenance programs for the network on the basis of this data. The RMU must perform three major tasks to accomplish these objectives: collect data, on a continuous basis, on both paved and unpaved roads; create and maintain a data bank; and develop annual medium- and long-term periodic resurfacing programs, including cost estimates and economic justifications.

**Data Collection**

The immediate goal of the RMU was to produce credible periodic resurfacing programs. In view of the limited human and financial resources available, data collection was confined to the parameters that were necessary to achieve this goal.

Some information was assembled without field visits, such as the definition of the network, historical information on each road link, and quarry locations. In Niger, the PWD is officially responsible only for "classified" or national highways. However, partly because the PWD is the only organization with maintenance capabilities, and partly because the official classification system is out of date, the PWD actually maintains more than the classified network. The maintained network, therefore, includes paved and unpaved national, regional, and rural roads, all managed by the PWD. A reference system of nodes and links was defined for this network. Each link is homogeneous as much as possible from the point of view of traffic and class of road.

Other basic information includes the history of each link in the network, such as the dates of original construction, major resurfacing, and strengthening; quarry locations; and quality and quantity of available materials. Long stretches of road in Niger are far from suitable road building materials and transport is a major element of maintenance costs.

The collection of data by field survey was not the responsibility of any existing PWD unit. The RMU, therefore, established, trained and administered its own survey crews, three for traffic counts and one for road inventory and condition surveys.

**Traffic Axle Load Surveys**

Traffic data are collected by manual and automatic
counts by three crews based in regional centers. The count program is in operation eleven months each year. The manual counts last for either three or seven days; the three day counts include a local market day. These counts include a classification of vehicles into five types.

Automatic counts are performed only on paved roads. The RMU has twelve counters, eight of which are electronic and are read by a portable microcomputer (an Epson NX20) onto cassettes. They are used with magnetic loop detectors. The other four are of an older electromechanical type and are used with pneumatic tube detectors.

Axle load surveys are performed using portable scales, and the RMU has also introduced in-motion weighing on an experimental basis using a piezo-electric cable. The cable is positioned in a transverse slot in the pavement, which is then filled with epoxy. The passage of an axle produces an electric signal that varies with the load, and the reading is stored in an electronic control box. The reading is calibrated using standard loads. The cable needs a stable platform for accurate measurements. Because the pavements in Niger were relatively light and flexible, the RMU decided to install the cable in the center of a 30m-long Portland cement concrete slab. Arrangements were made with the European Development Fund (EDF) to include the slab in an ongoing EDF-financed contract to widen and strengthen a section of the main east-west highway. The electronic recording system produces a histogram of the number of passing axles in five classes: 1 to 5, 5 to 9, 9 to 13, 13 to 16, and more than 16 metric tons. The legal limit for a single axle in Niger is 13 tons, or 28,600 metric lbs. If the experimental installation is successful, similar installations are expected to be made on other sections of the paved road network.

Road Inventory and Condition Surveys

Pentakilometer (5-km) markers were placed on all paved roads and they are generally accurate. However, road improvements that shorten the alignment can upset the accuracy of all subsequent kilometer markers. An independent kilometer reference system was, therefore, established, and the existing kilometer posts were incorporated into it. Most unpaved roads do not have pentakilometer posts. Distances on these roads were measured with a precise odometer (Halda Twinmaster), and special markers were placed.

A windshield survey is a conventional, detailed visual analysis that is performed in a car and, when necessary, on foot. Distances are recorded with the precise odometer, and the roadside kilometer markers were incorporated into the measurements. The following three groups of data are recorded:

- road characteristics, such as pavement width, right and left shoulder width, presence of village or junction location, and type of drainage structure;
- roadside condition, such as right and left ditches, right and left shoulders, and cut or fill section; and
- pavement condition, such as condition of surface treatment, cracking and deformation.

The pavement condition characteristics are recorded on a scale of 0 to 5, from excellent to bad, for the surface treatment, and 0 to 3 for the extent of cracking and deformation. Data collected for unpaved roads are width, presence of corrugations, gravel loss, potholes, rutting depressions and crossfall.

The French APL 25 longitudinal profile analyzer was chosen to measure road roughness. The local crew was trained in its use by a technician from the French Central Roads and Bridges Laboratory. The APL 25 records results on a standard cassette, which is directly read by a digital cassette reader for automatic input to the RMU’s computer. The software, in addition to expressing to road roughness on the normal CAPL 25 scale, converts the results into the International Roughness Index scale, which is used as a standard input to the World Bank’s Highway Design and Maintenance Standards Model (HDM). Complete surveys of the paved road network in Niger were performed in 1985 and 1986.

Economic Data

Three groups of economic data are collected: the unit costs of construction, rehabilitation and maintenance, for both periodic and routine maintenance by contract or by force account; vehicle operating costs; and macroeconomic and traffic forecasts.

Data Input and Storage

The RMU was instrumental in introducing electronic data processing to the Ministry of Public Works. A list of equipment was determined in 1984 and the following items were chosen at that time:

- a Victor S1 computer with 512 kbytes of memory and two floppy disks with 1.2 mbytes of memory,
- an Alpha 10 computer with 2 x 10 mbyte cartridges (Bernouilli Box).

Maintenance Policies

First, a decision methodology was established. In 1986,
the software that automatically read and input the APL roughness data was not yet available. Therefore, decision criteria were used from the three pavement condition evaluations of the windshield survey: surface treatment condition, cracking, and deformation. The first two are indications of surface distress, and the third of problems in the pavement structure below the surface. A two-dimensional decision grid was, therefore, developed based on surface distress, defined as the sum of surface treatment condition and cracking and deformation. The types of maintenance intervention, which ranged from routine maintenance to strengthening the overlay and rehabilitating the road, were then related to the cells in the grid as shown in Figure 1.

The thresholds and the different types of maintenance works in the decision grid were positioned on the basis of engineering judgment. The positioning of these thresholds was the subject of considerable discussion between engineers from the government and the World Bank. They considered engineering standards that were commonly used in Niger and West Africa, and the results of World Bank research in other parts of the world. Because the great majority of surfaces and pavements in Niger were in good condition, persons who conducted the windshield condition survey tended to rate the road severely. The grid therefore might need to be extended for use by other countries. Traffic was not explicitly considered in establishing the maintenance thresholds for surface dressed roads as it is unsoundly low—only about one-fifth of the paved network has an ADT of more than 300 and the highest traffic volume is less than 1,000 vehicles per day.

Maintenance Model

A simplified version of the World Bank's HDM was applied in Niger. The inputs to the model are the road inventory (both fixed and variable conditions), traffic data, economic data, and the maintenance policy decision grid.

The model first sets default values for required HDM input data that are not collected in Niger, and transforms the Niger survey ratings for surface treatment condition, cracking, and deformation into HDM units. This provides the initial condition for the simulation which is run with a specified or null maintenance policy. The model predicts the condition of the road section at the end of the year, as a result of its initial condition and the effects of traffic and climate derived from the HDM equations that were calibrated to conditions in Niger. The predicted condition is then compared to the maintenance policies to determine if work would be required on a road section. If so, the maintenance quantities and costs for the section are calculated. Then, the updated road condition is calculated. This road condition then becomes the input for the second year of the simulation cycle, which is repeated for the total number of years of the analysis. The simulation cycle for Niger was ten years.

Figure 1. MAINTENANCE POLICY DECISION GRID
The total vehicle operating costs over the road section for each year are calculated, depending on the forecasts of both traffic and road conditions. The total transport costs, which consist of vehicle operating costs and maintenance costs, are summed for all sections of the road link. The total costs are then compared for the null alternative with other maintenance policies. Then, the costs are discounted to develop an economic rate of return for the investment in periodic resurfacing on the road link.

It should be noted that this analysis is performed for each homogeneous section of a road link. In practice, the type of maintenance applied can vary in roughly 100m lengths. This level of analysis is therefore needed to produce an accurate estimate of the quantities of maintenance works.

Contract Documents

For lots that consisted of road sections that do not need to be strengthened, the results of the RMU analysis are sufficient to be directly incorporated in the bills of quantities in contract documents. However, although the average costs of improving severely deformed sections are used to permit the RMU to develop a program of works and its economic justification, the level of analysis is insufficient to define detailed engineering for construction. A conventional engineering study needs to be performed for such sections, including deflection testing and test pits to identify the cause of the problem, and to permit the improvement in pavement structure to be properly designed.

Results of the Analysis

The Government of Niger has as a stated policy to preserve the large public investment in roads. Despite financial difficulties, a satisfactory level of funding has been allocated in the investment budget to periodically maintain the road network. The general policy of the government and the trend among foreign donors to lend money for road maintenance have both been strengthened by the RMU analysis. Budgetary allocations for this purpose are now supported by several donors.

Future Development

The maintenance program that is currently being executed was based on the decision grid of maintenance policies related to pavement condition. The next step in the program was to refine the decision grid. The vehicle for this is a national transport study that is now in progress in Niger. One important element of this study is the installation of the full HDM program in Niger. This is now possible because the HDM has been restructured to run on microcomputers with the capabilities of the IBM AT. The network data in the RMU data bank will be used to examine the sensitivity of the thresholds that trigger each maintenance task. A wide range of different policies will be tested and applied to links and sections that are representative of the whole road network in Niger. The economic results will then be calculated. A series of iterations will enable national maintenance policies to be refined. These policies can then be applied to the link analysis to develop annual maintenance programs and budgets.

Conclusions

As was stated earlier, Niger is a country with very limited human and financial resources. It is, therefore, important that the best possible use be made of all public expenditures, including highway maintenance. The Niger Road Maintenance Unit can ensure that funds are spent on those projects that give the highest returns by using the methods and techniques described in this study."
The federal trunk road system in Nigeria consists of 29,500 km of roads of which 28,600 km are outside urban areas. The replacement value of this system, excluding major bridges and urban roads, is estimated to be N18.5 billion (US$1.00=N4.8 in 1988). There has been a substantial improvement in the road system over the last ten years. During that period, the proportion of bituminous-surfaced roads in the system increased from 58% to 73% to a present length of about 23,000 km including 985 km of dual carriageways. The road types are:

- Asphalt concrete 15,509 km
- Surface dressed 7,251 km
- Gravel or earth 5,811 km

The condition of the network has deteriorated since 1985 because of financial and institutional constraints affecting road maintenance and strengthening activities.

<table>
<thead>
<tr>
<th>ROAD SURFACE TYPE</th>
<th>Total Length (km)</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Paved</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dual carriageway</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asphalt concrete</td>
<td>985</td>
<td>845</td>
</tr>
<tr>
<td>Single carriageway</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asphalt concrete</td>
<td>14,520</td>
<td>12,140</td>
</tr>
<tr>
<td>Surface dressed</td>
<td>7,255</td>
<td>2,950</td>
</tr>
<tr>
<td><strong>Unpaved</strong></td>
<td>28,570</td>
<td>15,935</td>
</tr>
<tr>
<td>Gravel</td>
<td>4,300</td>
<td>-</td>
</tr>
<tr>
<td>Earth</td>
<td>1,510</td>
<td>-</td>
</tr>
</tbody>
</table>

The condition of the federal highway system is summarized below:

- % Good: (100%)
- % Fair: (56%)
- % Poor: (28%)

This neglect of maintenance and the failure to carry out timely strengthening of roads over the last decade has already contributed to a loss of about N2.0 billion in the capital stock of the federal highways.

Road traffic declined between 1983 and 1987 in the wake of the 1982-83 economic recession and the ensuing financial crisis. It is estimated that road traffic at present is 15-20% below the pre-1983 levels. The

distribution by traffic class is as follows:

- More than 10,000 veh. per day (vpd) 652 km
- 1,500 to 10,000 vpd 10,800 km
- 300 to 1,500 vpd 12,258 km
- 150 to 300 vpd 3,360 km
- Less than 150 vpd 1,500 km

The aggregate inter-urban traffic on federal highways is estimated to be 60 million veh-km per day. The corresponding expenditure by road users (the cost of operating the vehicles) is estimated to be N62.6 million per day or N23 billion per annum. The extra costs incurred by road users because of suboptimal maintenance of inter-urban routes are about N810 million per annum. The foreign exchange component of this extra expenditure in terms of extra fuel, tires, spare parts, and the wear and tear on vehicles is about N647 million per annum, mostly borne by the road users in the private sector.

Maintenance Policy

The basic maintenance policy of maintaining about 5,600 km of the network by force account, and the remainder (24,500 km less sections under rehabilitation contracts) by contract is good. However, only some 11,000 km of the network received routine maintenance, either force account or contract, in 1988. The problem does not appear to be so much a shortage of recurrent budget, it is more the diversion of the recurrent budget to pay for capital items.

The management of maintenance needs considerable improvement. The techniques of assessing the needs, and planning, organizing and executing the works, are weak and the Federal Ministry of Works and Housing (FMWH) should implement a sound maintenance management system. The present system is largely one of reaction to crisis and works as long as ample funds are available. In a period of financial constraints it is a recipe for chaos.

A maintenance activity which is little employed in Nigeria is resealing, or bituminous surface treatment. This is a vital operation for preserving pavements, particularly in the higher rainfall areas. It appears that pavement resealing could be financed from the recurrent budget under the current budgetary practice. A second maintenance activity which should be implemented is a bridge inspection program. Bridges should be regularly inspected for signs of deterioration, which can then be treated before there is a catastrophic failure.

Budget Preparation

The Federal Highway Department’s (FHD) present budget preparation procedure is not related to the Government’s overall financial constraints. The FHD prepared a budget following their normal method but this did not comply with the guidelines issued by the Ministry of Planning and Budget, which indicated that the 1988 budget should not exceed releases for 1988. The budget in 1989 for federal highways was N315 million but releases were only N210 million. The budget request for 1989 should therefore have been about N210 million, but the FHD request for 1989 was N1,390 million which obviously was totally unrealistic. This request immediately covered only ongoing contracts and projects on the point of award.

The difference between available financial resources and needs is so great that prioritization is essential. The budget request should show priorities so that if the allocation is less than the request it can be rationally accommodated. In addition, an economic assessment of returns on each project would demonstrate to the decision makers the benefits that were being forgone from projects not included. In the case of federal highways these economic benefits are mostly very high. The following general priorities are proposed, basically on economic grounds:

- completion of ongoing projects which are substantially complete (e.g., more than 85% complete)
- other ongoing overlay projects
- other ongoing rehabilitation projects
- completion of other ongoing projects
- upgrading gravel and earth roads to bituminous standard where it is justified by the volume of traffic
- new construction.

Consequences of Underbudgeting

If the future funding for federal highways is continued only at the level of the 1988 allocation, the pace of deterioration will increase resulting in a high road transportation costs with obvious economic implications. Later, bringing the network back to a reasonably good condition will be extremely costly. The consequences of underspending on the rehabilitation of federal highways are serious. By 1993, the condition of the federal highways will have deteriorated to: 44% Good, 21% Fair, and 34% Poor, resulting in a reconstruction and rehabilitation backlog of N5.6 billion. In the meantime, the extra costs borne by road users will have risen to N1.6 billion per annum compared to N0.8 billion in 1988. The wasted resources in road user costs over the five-year period will amount to N6.0 billion with a foreign exchange component of N4.8 billion, assuming no growth in traffic. Thus,
underspending on maintenance and rehabilitation by N4.0 billion over the 1989-1993 period will exact the following toll:

<table>
<thead>
<tr>
<th>Amount</th>
<th>Foreign Exchange Component</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rehabilitation and Reconstruction Backlog: (if done after 1993)</td>
<td>N5.6 bn</td>
</tr>
<tr>
<td>Extra Road User Costs (1989-93)</td>
<td>N6.0 bn</td>
</tr>
<tr>
<td>Total</td>
<td>N11.6 bn</td>
</tr>
</tbody>
</table>

The extra road user costs will result in increased transport costs which will be passed on to shippers and consumers in higher freight rates and passenger fares. The current condition of Shagamu-Benin Expressway is a good illustration of this situation where road transport companies have announced their intention to increase their freight and passenger rates if the road is not urgently put back into good condition. In addition to the above road user costs, there will be time delays to passengers and in-transit inventory costs, which can become very high for high value manufactured goods and perishable agricultural commodities.

**Maintenance and Restoration Needs**

The program of road works to check further deterioration of federal roads, eliminate the maintenance backlog over the next five years, and gradually reduce the wasted resources in extra road user costs, as set out in detail above, is summarized in the table below.

### ANNUAL PROGRAM OF ROAD MAINTENANCE AND IMPROVEMENT WORKS (1989-1993)

<table>
<thead>
<tr>
<th>Work Item</th>
<th>Objective</th>
<th>Length of Road (km)</th>
<th>Expenditures over 5 years (N million)</th>
<th>Annual Expenditure (N million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Capital</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asphalt concrete overlays</td>
<td>To provide adequate strengthening of roads in still fair to good condition.</td>
<td>1,700</td>
<td>522</td>
<td>104</td>
</tr>
<tr>
<td>Reconstruction (surface dressed)</td>
<td>To eliminate the backlog of deferred maintenance on roads which have as a consequence deteriorated to poor condition.</td>
<td>1,225</td>
<td>432</td>
<td>86</td>
</tr>
<tr>
<td>Reconstruction (asphalt-concrete)</td>
<td>To eliminate the backlog of deferred maintenance on deteriorated roads in poor condition which carry heavy traffic.</td>
<td>1,000</td>
<td>530</td>
<td>106</td>
</tr>
<tr>
<td>Upgrading of gravel roads to paved standards</td>
<td>To reduce the excessive cost of vehicle operation on gravel and earth roads where justified by the level of traffic.</td>
<td>3,210</td>
<td>1,548</td>
<td>310</td>
</tr>
<tr>
<td>Sub-total Capital</td>
<td></td>
<td>3,032</td>
<td>606</td>
<td></td>
</tr>
<tr>
<td>B. Recurrent</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resealing</td>
<td>To preserve roads in fair to good condition.</td>
<td>1,000</td>
<td>Annually</td>
<td>100</td>
</tr>
<tr>
<td>Routine maintenance</td>
<td>To maintain an acceptable level of service and prevent deterioration of the network.</td>
<td>24,000</td>
<td>Annually</td>
<td>126</td>
</tr>
<tr>
<td>Other maintenance</td>
<td></td>
<td></td>
<td>Annually</td>
<td>47</td>
</tr>
<tr>
<td>Sub-total Recurrent</td>
<td></td>
<td></td>
<td>273</td>
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</table>
Economic Justification

The estimated economic rates of return for the five-year program of road maintenance and improvement program are summarized below:

<table>
<thead>
<tr>
<th>Work Item</th>
<th>Road Length (km)</th>
<th>Total Expenditure</th>
<th>Length of Road (km) with Economic Rates of Return</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>over 100% 30-100% 12-20%</td>
</tr>
<tr>
<td>- AC Overlays</td>
<td>1,700</td>
<td>522</td>
<td>225 900 575</td>
</tr>
<tr>
<td>- Reconstruction</td>
<td>2,225</td>
<td>962</td>
<td>510 1,050 665</td>
</tr>
<tr>
<td>- Upgrading of Gravel Roads</td>
<td>3,210</td>
<td>1,548</td>
<td>215 1,265 1,730</td>
</tr>
<tr>
<td>to paved standards</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Resealing (recurrent)</td>
<td>5,000</td>
<td>500</td>
<td>70 3,000 1,930</td>
</tr>
<tr>
<td>Total</td>
<td>12,135</td>
<td>3,532</td>
<td>1,020 6,215 4,900</td>
</tr>
</tbody>
</table>

These high economic returns provide a strong and clear justification for the proposed capital expenditures of N3.8 billion (including provision for ongoing projects) and recurrent expenditures of N273 million a year over the 1989-93 period. On an annual basis, the proposed expenditure of N760 million plus routine maintenance expenditures of 273 million amounts to 5.5% of the value of the road capital stock and only 0.7% of DGP, a very reasonable level of highway maintenance and improvement expenditures by international standards. As a proportion of the total budget, this amount is less than was allocated in the late 1970s and early 1980s.

Bridging the Resource Gap

The shortfall in the needed expenditures on federal highways can be met through domestic resource mobilization through road user taxes and tolls, and by external borrowing. At present the revenues from road user taxes (import duties and excise taxes on vehicles, tires, spare parts etc) are more than offset by the subsidies on gasoline and automotive diesel. While it may be difficult to contemplate additional taxes on road users in the current economic and political environment, full cost recovery should be a medium-term objective in the roads sector. The introduction of tolls on bridges and expressways, however, provides an additional source of highway funding. Based on the rather simple toll schedule recently introduced and current traffic levels, revenues from bridge and highway tolls should amount to about N66 million per annum (Lagos-Ibadan N20 million; Shagamu-Benin N10 million; Lagos-Badagry N10 million; Enugu-Port Harcourt N9 million; Obene-Ajaokuta N2 million; Onitsha-Enugu N5 million; Bridges N10 million), provided there is no leakage of revenues. If the toll structure were set according to distance travelled and raised to the level of cost savings over comparable alternative routes, it should be possible to increase the revenue to about N150-200 million per annum. It would, however, be unwise to introduce additional tolls if the condition of the toll highways is not first improved. In order to raise the efficiency of toll collection, and to reduce leakage of revenues, we believe that the collection of tolls should be contracted out.
Preface

The purpose of this study is to demonstrate the extent to which the basic economic principles of road financing, e.g., through road user taxation, as expounded in the seminar paper on "Road Financing and Pricing in Developing Countries" are relevant to or can be applied to Tanzania. The extent and problems of applicability are discussed in the light of the prevailing structure and problems of road maintenance as well as cost recovery procedures in the country.

Introduction

Road transport is by far the most dominating mode of transport in Tanzania. It carries over 70% of the total traffic available. Despite its importance, the road transport sector has constantly been faced with severe problems of maintenance and rehabilitation, leading to serious bottlenecks in the procurement and distribution of goods and in passenger travel in the country. High operating costs, delays and safety risks are some of the outcomes of bad road conditions. The relatively proportion of poor rural roads adds significantly to the escalating operational costs of road transport. The poor performance in the transport sector in general and in road transport in particular has largely been a result of the past neglect of investment and maintenance of roads both in terms of domestic budgetary allocations and foreign exchange. For example, while in the neighboring countries the public investment program on roads is around 15% of total public investment, in the case of Tanzania it has averaged only about 3% in 1983/84 and 1987/88. Because of this fact and the declining level of road transport services, the Government has devised some measures in an effort to rectify the situation.

The Need for Mobilization of Resources

The country has an estimated total road length of 82,000 km. Trunk roads constitute about 10,000 km, out of which about 3,000 km are asphalt-paved. The rest of the trunk roads are gravel roads traversing certain regions and districts. Regional and district roads account for about 21,000 km and 14,600 km respectively. The remaining 36,400 km are rural (feeder) roads. An estimated total of over 72,000 vehicles are currently plying the roads of which the trucking fleet, comprising vehicles of different sizes and, hence differing aggressivity on the rehabilitated roads, is between 20%-30%. Despite the fact that the amount of investment or expenditures allocated to the transport sector is directly related to the social and economic development of a country, allocations directed to or through the Ministry of Communications and Works (MCW) have been declining over time. For example, government expenditure, both recurrent and development, in nominal terms on roads and bridges declined from 5.2% of total government expenditure in 1976-78 to only about 2.6% in 1987-88. Between 1967-68 and 1986-87, this share has been declining at an average annual rate of about 6.3%.

An equally important contributing factor to the general poor performance in maintenance has been the uncoordinated and inadequately defined relationships between the MCW, Regional Authorities (for example Regional Engineers), and the Local Governments (District Engineers).

The Government has launched a massive five-year rehabilitation and maintenance program of some major roads in the country. Through this program, to which the Government is fully committed, it is anticipated that about 70% of the paved and gravel roads should be in reasonably good condition by 1992. For this purpose, the Government's investment budget share should increase from the present low level of 3% to about 15% by 1991-92, after which it should stabilize at 12%. As for the rural roads sector, a "Core Rural Roads Rehabilitation and Maintenance Program" has been formulated by the Government for their systematic improvement. About 25% of the 6,000 km of rural roads selected from 24 districts will be rehabilitated and upgraded to gravel standard. Reclassification of these roads will increase the gravel roads network by almost 55%. The rest of the earth roads will receive minimal maintenance due to their anticipated low traffic levels.

Since effective regular maintenance is equally important for the rehabilitated roads to remain operational over a longer period, the balancing of development and maintenance of the growing infrastructural (road) stock requires an optimal allocation of financial and technical resources as well as improvement of institutional capacity for the control and proper use of resources. The institutions should be able to develop prioritization schemes for maintenance implementation, particularly where capacity and resources are inadequate for total work coverage.
Current Road Taxation System

At present, the road user taxation instruments have a complex structure with a high level of inconsistency in taxation rates, collection supervision and/or monitoring. The instruments applied are registration tax, vehicle license fees, fuel tax, sales taxes on vehicle transfer, road toll taxes, import duties and sales taxes and foreign vehicle license fees. A detailed account of the complexity of each instrument is outlined in the World Bank document entitled “Financial Performance of the Public Sector in Tanzania”. A summary of road user revenues and expenditure between 1985-86 and 1987-88 is shown in Appendix 1.

The total revenues collected through road user taxation amounted to Tsh. 1,996 million in 1985-88, compared to Tsh. 6,454.47 million the previous year. Within the tax regime road tolls contribute the largest proportion (34-40%) of revenue while motor vehicle registration contributes the lowest proportion (2-3%).

The total revenues mobilized through these instruments is much less than the projected theoretical levels. Total road user charges expected to be collected in 1985/86 was Tsh. 3,192.28 million compared to the amount actually collected, Tsh. 1,996.99 million or 62.6% (5). This discrepancy is explained by lack of control and monitoring resulting in undercollection, evasion and/or misappropriation.

In comparing revenues and maintenance expenditures however, it should be noted that road taxation in Tanzania is one of the principal ways of mobilizing resources for general revenue generation, as well as for road maintenance.

Annual Maintenance Requirements

Of the Tsh. 6,454.47 million total revenue collected in 1987-88, only Tsh. 2,652.71 million (41%) was allocated for road maintenance and the rest was contributed to the general tax revenue. The subdivision of this expenditure is shown in Table 1 below. Development expenditure is relatively higher than recurrent expenditure from this source except for district roads.

Table 1. SUB-DIVISION OF ROAD EXPENDITURES IN 1987-88
(Tsh. million)

<table>
<thead>
<tr>
<th></th>
<th>Trunk Roads</th>
<th>Regional Roads</th>
<th>District Roads</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recurrent Expenditure</td>
<td>855.84</td>
<td>230.00</td>
<td>110.00</td>
<td>1,195.84</td>
</tr>
<tr>
<td>Development Expenditure</td>
<td>1,086.28</td>
<td>269.55</td>
<td>101.06</td>
<td>1,456.89</td>
</tr>
<tr>
<td>Total</td>
<td>1,942.12</td>
<td>499.55</td>
<td>211.06</td>
<td>2,652.73</td>
</tr>
</tbody>
</table>


The road maintenance budget falls far short of requirements. At the same time, it has been established (World Bank) that revenues raised from road users during the past three years have been well in excess of expenditures on roads. Annual averages generally exceeded expenditures by a factor of about two. Hence road user taxes make a significant contribution to overall government revenue. However, this positive balance was achieved through spending less on road maintenance than was actually required in the long term to keep the roads in a stable, good condition. On an overall basis, an estimated Tsh. 2,100 million should have been spent on routine and periodic maintenance in 1985-87; the comparable figures are Tsh. 5,200 million against Tsh. 1,940 million actually allocated. A shortfall was also observed in 1987-88 where Tsh. 7,700 million was required but only Tsh. 2,380 million was budgeted. On trunk roads maintenance requirements, statistics from MCW (Appendix 2) indicate that a declining ratio of allocation to the actual requirements will have to be compensated for in the future maintenance programs.

The estimated cost of eliminating the nationwide backlog of road maintenance, in order to keep the road network in a stable condition, amounted to Tsh. 950 million in 1985-86, rising to Tsh. 3,300 million in 1986-87 and Tsh. 5,300 million in 1987-88. The routine and periodic maintenance requirements, making up a sizeable volume of total rehabilitation requirements, are the activities that represent the largest backlog.

Organization and Sources of Finance

In order to avoid future cycles of road deterioration and to reduce the financial gaps for maintenance, it is impe-
rative that the agency responsible for the collection of resources be capable and well organized. Where user charges constitute a significant proportion of actual maintenance expenditure, the scope for self-financing for road infrastructure increases, i.e., charging for service under the cost recovery umbrella not only augments road user revenues but also induces more rational and efficient use of available resources.

At present the Ministry of Finance, Planning and Economic Affairs through its Customs and Sales Tax department, is the sole collector for the bulk of user charges. Another road revenue raising agency is the Transport Licencing Authority (TLS) under the MCW. All the collected revenue is directed initially to the central general pool in the Ministry of Finance. However, these two institutions appear to be less efficient in revenue collection mainly due to lack of qualified personnel and shortage of working facilities, which usually result in low collection rates.

The Objectives and Structure of Current Road Taxation System

At present there is no earmarking of resources for specific purposes, and there are also no binding requirements for the allocation of resources. Each Ministry prepares its budget which is presented and discussed in the Ministry of Finance. Usually the ministerial budgets have to conform to some predetermined ceilings. According to government officials some changes in this policy are anticipated in the near future. However, given the Government’s commitment to improve the transport sector, there is need for a fresh look into the question of earmarking and establishment of a “Road Fund” for this particular Ministry. Earmarking has the advantage that funds could be made directly available to the responsible ministry for the intended use. However, it is often difficult to maintain such a “Fund” because of the possible repeated “borrowing” from such revenues for other uses by the central government. At the same time it would be necessary for the Ministry to establish a certain level (cutoff-point) after which the “surplus” generated from the road user revenues would be diverted to the central pool of the treasury. It is quite clear that, despite the government’s weak fiscal situation, it is hardly possible to sacrifice the total road sector’s contribution to the general revenue.

Nevertheless, the contribution of some of these taxes, especially motor vehicle taxes, to total government tax revenue is expected to be only about 1.6% in 1988-89. This share is translated into Tsh. 958.71 million, which could be earmarked for the “Road Fund” without much distortion in the total government revenue basket. It then becomes a real user charge. Contributions from other sectors to the “Road Fund” are another possibility considering the central role that the transport sector plays in supporting the other sectors.

Comparison of the Current Road Taxation System with Marginal Cost-Based System

The current taxation system has some deficiencies which would render the applicability of the marginal cost-based pricing system, despite its theoretical merits, difficult. In the first place, current road user taxes do not accrue with the seven taxing criteria outlined in the Seminar Paper (page 7). The charging of road tolls at present varies with the weight of the vehicles, the heavier ones paying more, but not with distance. This takes only partial account of the vehicle aggressivity on roads. Fuel tax, which varies less than proportionally to aggressivity, is distorted further by the fact that diesel fuel is heavily subsidized by the lighter gasolines. This runs counter to the marginal costing requirement that charges should rise in line with aggressivity. However, the subsidization is deemed necessary by the Government, in order to keep the transportation costs bearable to the majority of the customers who are largely agricultural producers scattered all over the country. The import duty and sales tax structure also is not directly related to vehicle aggressivity, which is yet another departure from the marginal costing principle.

Thus, the general structure of the road taxation—through the various instruments and the heavy subsidization of diesel fuel, together with the conditions that provide loopholes for tax evasion and/or misappropriation—does not meet the requirements for a short-run marginal cost pricing principle. In short, it fails to meet the three marginal costing criteria given in Chapter II of the Seminar Paper. However, the second best alternative would probably be the adoption of the average cost pricing principle that would at least, under the present conditions, ensure the recovery of all costs. The standard costs could be established and built in a “Road Fund” that would maintain a certain level of road maintenance in the long run.

Another obstacle to marginal cost pricing, experienced to some extent in Tanzania, is the unrealistically low pricing of road transport services required by the public authorities which is common. Usually, officially controlled rates fall short of operating cost coverage. They are also standardized without taking into consideration the different operating conditions in the country. Hence there is need to permit rates to rise to the levels sufficient to cover not only operating costs but also acceptable margins for own reinvestment and road user tax contributions, perhaps through a “Road Fund”. The reduction in operating costs following the resulting infrastructural rehabilitation and maintenance should protect the road transport user, partially if not wholly, from an increase in rates. Another possible revenue raising measure would be necessary to broaden the tax-base to include all the direct and indirect beneficiaries of road transport (although this is not a requirement of the marginal cost pricing theory).
Modification of Road Taxation System in Accordance with Marginal Cost Pricing Principles

The means by which the existing taxes, assessed above, could be modified to bring them more closely into line with marginal cost principles. For example, license and registration fees for different vehicle types should be sufficiently differentiated to take into account differing degrees of vehicle aggressivity. In addition, axle load taxes which reflect vehicle aggressivity could be introduced and enforced. Tolls should be restructured to take into account distance as well as vehicle weight (although this may raise problems of collection and administration). Finally, the Tanzanian fuel tax system, which allows subsidization of diesel fuel for the heavier vehicles, distorting even more the link with vehicle aggressivity, should, perhaps, be reconsidered.

Changes in this direction would bring the curve of road tax charges according to vehicle type more closely into line with the corresponding maintenance cost curve as depicted in the diagram at the end of the Seminar Paper.

References

1. Economic Survey 1987, June 1988, DSM.
2. Economic Survey, Various Issues, DSM.
4. National Transport Policy (Drail), Ministry of Communication and Works, June, 1987, DSM.
6. World Bank: op. cit., (Appendix Table 6).
7. Customs and Sales Dept; Revenue on Imports for the Financial Year: 1987-88.
8. World Bank, op. cit.
9. Ministry of Finance, Economic Affairs and Planning, DSM.
Appendix 1: ROAD USER REVENUES AND EXPENDITURES 1985/86-1987/88

(Tsh. million)

<table>
<thead>
<tr>
<th></th>
<th>1985/86</th>
<th></th>
<th>1986/87</th>
<th></th>
<th>1987/88</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Amount</td>
<td>% of rev.</td>
<td>Amount</td>
<td>% of rev.</td>
<td>Amount</td>
<td>% of rev.</td>
</tr>
<tr>
<td>1. Revenue</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A. MV Taxes &amp; Licenses</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MV Registration Tax</td>
<td>8.04</td>
<td>2.6</td>
<td>8.54</td>
<td>2.4</td>
<td>12.66</td>
<td>2.8</td>
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<td>MV Transfer Tax</td>
<td>36.20</td>
<td>11.7</td>
<td>38.15</td>
<td>10.7</td>
<td>55.28</td>
<td>12.2</td>
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<tr>
<td>MV Road License</td>
<td>55.74</td>
<td>17.9</td>
<td>55.74</td>
<td>15.6</td>
<td>105.54</td>
<td>23.2</td>
</tr>
<tr>
<td>Road Toll Tax</td>
<td>122.88</td>
<td>39.5</td>
<td>137.63</td>
<td>38.5</td>
<td>156.08</td>
<td>34.3</td>
</tr>
<tr>
<td>Transport Licensing Fees</td>
<td>15.83</td>
<td>5.1</td>
<td>17.34</td>
<td>4.9</td>
<td>30.13</td>
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<tr>
<td>Sub-Total</td>
<td>310.80</td>
<td>100.0</td>
<td>356.96</td>
<td>100.0</td>
<td>454.47</td>
<td>100.0</td>
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<tr>
<td>B. Gasoline (Premium)</td>
<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>Gasoline (Regular)</td>
<td>684.30</td>
<td>40.6</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Diesel Fuel</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Motor Vehicles</td>
<td>555.42</td>
<td>33.0</td>
<td>3500.00</td>
<td></td>
<td>6000.00</td>
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<td>MV Spare Parts</td>
<td>214.56</td>
<td>12.7</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other Items</td>
<td>211.28</td>
<td>12.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sub-Total</td>
<td>1686.19</td>
<td>100.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Total Revenue</td>
<td>1996.99</td>
<td>3859.25</td>
<td>6454.47</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Expenditure</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Expenditure/Roads</td>
<td>1337.09</td>
<td></td>
<td>2191.81</td>
<td></td>
<td>2652.71</td>
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</tr>
<tr>
<td>Contribution/Gen.</td>
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<td></td>
<td>1667.44</td>
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<td>3801.74</td>
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<td>Taxation</td>
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<td></td>
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</tr>
<tr>
<td>Total Expenditure</td>
<td>1996.99</td>
<td></td>
<td>3859.25</td>
<td></td>
<td>6454.47</td>
<td></td>
</tr>
<tr>
<td>Shortfall in Regular Maintenance</td>
<td>(950.00)</td>
<td>(3,330.00)</td>
<td>(5,300.00)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The inefficiency of road maintenance systems and poor utilization of manpower and equipment have prevented investments in road maintenance from being fully effective in many Sub-Saharan African countries.

Effective and efficient management of operations is crucial to addressing Sub-Saharan Africa's road deterioration problem by salvaging roads that have deteriorated severely and protecting newer routes from a similar fate. More effective management that produces demonstrable improvements in both the condition of roads and the efficient use of resources is also a key to creating the political commitment necessary to increase attention to—and funding for—maintenance. It can also be a powerful tool for saving money, particularly foreign exchange.

Most road maintenance operations in Sub-Saharan Africa are run by large establishments operating by force account with geographically widespread operations that rely heavily on equipment. Maintenance operations planning and execution often overlap, and information systems are not adequate for management to track the quantity and quality of performance or assess and prioritize needs. Maintenance managers have also been overburdened by the need to keep up huge—and often incompatible—equipment fleets and supervise large, far-flung work forces. Information flow and streamlined management tasks are perhaps the two key factors in improving management efficiency.

This paper summarizes and addresses four key policy issues affecting the operation and management of road maintenance and rehabilitation in Sub-Saharan Africa:

- increasing accountability by improving information systems so maintenance managers can effectively plan and track performance. In many cases, this will involve separating responsibilities for planning and monitoring functions from responsibilities for works execution;

- adapting the size of mechanical equipment fleets to reflect maintenance potential and increasing the efficiency of equipment use by relying on private contractors;

- spinning off management burdens through increased use of contractors; and

- adopting appropriate technology and design standards and using local resources for self-reliance and sustainability methodologies that allow increasing decentralization.

These issues and some options available for addressing them are discussed below. They are covered more fully in the three background papers prepared under RMI Seminar Topic B: "Operations and Management."

Accountability

Problems

A lack of internal accountability impedes the effectiveness of many road maintenance authorities in Sub-Saharan Africa. Designing and implementing systems to monitor a vast road network's condition and the quantity, quality, and timeliness of performance of maintenance operations is difficult in all countries. It is, however, a key to effective planning and the efficient use of resources—and crucial for convincing political and financial authorities of the need for budgetary resources and the effective use of previous allocations.

Policy Options and Actions

Several steps can be taken to improve accountability in road maintenance operations. One (discussed more fully under Topic C: Institutional Reform and Human Resources Development) is structural: separating monitoring and planning from execution can strengthen both functions. The rationale for such a separation is similar to that commonly found on the financial side of almost all government operations: those who carry out tasks seldom have the time, the training, or the objectivity to judge either financial or operational performance.

Separation of operations and their monitoring can take many forms. Some agencies will opt to develop cadres specifically trained in this function. Others will recast their organizational structures to concentrate on supervision and monitoring while spinning operational functions off to contractors. Monitoring can also be approached by creating an independent unit analogous to those that carry out financial audits, or by using private firms.
Whatever path is taken, a management information system will be required to track and analyze operational progress. While computerized systems offer many advantages in data collection, storage, and analysis, great care must be taken not to impose massive amounts of new technology more quickly than often can be absorbed. Technology must also not be allowed to divert attention from the more basic task of designing and organizing a system for gathering regular and reliable field-level data. One lesson learned in both the developing and the developed countries is that a changeover to computer-based systems should be done in carefully phased steps.

African Experiences

A number of Sub-Saharan African countries make use of maintenance management systems which can be adapted to ensure the desired accountability for maintenance operations. Maintenance management systems have been tested in Ethiopia, Ghana, Malawi, and Zimbabwe. However, these systems need to be supplemented with monitoring and evaluation functions.

In the U. K., for example, county road authorities have to publish annual reports that show their costs in comparison with private contractors' charges.

Increasing the Efficiency of Equipment Use

Problems

Many Sub-Saharan African country roads authorities are trying—and often failing—to keep up equipment and vehicle fleets that are too large and too diverse to be adequately maintained. Availability and utilization is very low; only about 20% of national road maintenance fleets is in working condition in some countries, and the plant that is available often operates at only 60% or less of its normal work-rate. New equipment rapidly deteriorates because of inadequate maintenance, shortages of spares, and inadequate operator training. Most existing fleets cannot be run or serviced economically in their present condition. The result is a fleet with unnecessarily high operating costs due to frequent breakdowns; this represents a large wasted investment, much of which is in foreign exchange.

Equipment management problems are aggravated by public sector financial controls and procurement regulations that hinder force account operations. Other rules and regulations often prevent equipment managers from contracting maintenance and other jobs to private agencies. Information systems are often weak and understate the real costs of equipment ownership. Where central mechanical departments are managed separately from highway maintenance operations, poor coordination—again, largely an information problem—often causes delays that further reduce plant availability. For most countries, foreign aid has been the major source of equipment and spares. That aid has sometimes also introduced unintended problems. Donors have sometimes provided more equipment than countries can efficiently manage; tied aid and international tender procedures have prevented standardization of equipment so that large and diverse spare parts stocks have to be created and coordinated, while technical personnel needs additional training in operating and repairing equipment.

Policy Options and Actions

Most countries will benefit from reducing and consolidating their equipment fleets to a size and composition they can manage efficiently within the capabilities of available staff, funding and support services. A smaller fleet with higher availability and utilization rates will save money while raising productivity and reducing unit costs and management overhead. Equipment maintenance itself can often be consolidated by creating equipment pools as separate single-purpose management units from which the roads authority can "hire" a plant.

Beyond some point, consolidation and rationalization may make fleets too small to carry out all the work needed on the roads. Careful analysis—again, based on good information and costing data—is then needed to assess whether some equipment maintenance tasks can be cost-effectively contracted out.

Outside firms can also be used to reduce a roads authority's equipment maintenance burden. Plant and equipment can be hired from private sources, or private firms can be contracted to maintain equipment. In countries in which the private sector is not yet capable of entirely taking over such tasks, this can be combined with pooling some plant maintenance within the roads authority. This can have an added advantage of creating a business environment in which the private and public sector compete to foster efficiency.

Private contractors that use and maintain their own fleets can be used for most road maintenance tasks while a "core" fleet of equipment carries out essential works best managed by the roads organization.

Private firms may require strengthening to play an expanded role in contracting and equipment maintenance, and governments may well find it economic to provide training in the requisite skills to build up their capability. Standardization of equipment should also be sought, at least for the roads authority's fleet. Many countries need to institute firm policies and the discipline to maintain fleets of standardized equipment.
Donors should assist in this effort by coordinating their support to individual countries to aid standardization and providing foreign exchange for spare parts. Streamlining national procurement and supply regulations can also enhance equipment management efficiency.

**African Experience**

The options mentioned above have been tried in various countries with mixed success. For example, in Lesotho a government plant and vehicle pool was established in 1972, but even until 1983 the management problems mentioned above persisted. To resolve these problems, realistic hire rates were set and revised periodically to be in line with true costs. The fleet size was reduced by scrapping old unserviceable equipment and a core fleet maintained. Any additional equipment needed were hired from private owners. This system proved successful for plant hire. The combination of policy incentives has yielded positive results by reducing the effect low funding usually had on equipment maintenance and operation in Lesotho.

**Increasing Use of Contractors**

Almost exclusive reliance on public sector force account operations for road maintenance has led in many countries to overstaffing, lack of incentives for capable staff, rigid controls and rules that inhibit staff initiatives in adopting cost effective management solutions. While increased use of local contractors in road maintenance has been suggested as a possible solution, many roads departments lack the capacity for engineering, tendering and supervision of maintenance contract works needed to increase reliance on contractors. On the other hand, domestic contracting and construction industries are often underdeveloped.

The use of local contractors can increase efficiency and reduce costs if they can be mobilized to undertake road works. Market and competitive forces tend to act more strongly on private firms—especially small ones—than on public sector agencies. Their objectives are usually simple survival and profit and are not clouded by political considerations, and their relatively small size increases their flexibility. These factors motivate them strongly to use staff efficiently and maximize the use of labor rather than capital equipment to conserve resources.

**Possible Policy Options**

Stable markets and supportive policies are among the most important factors in encouraging development of local contracting industries. If contracting firms know they can expect work to be regularly available, they can invest in equipment and manpower that will strengthen their capabilities. Governments should consider offering training programs to private contractors to increase the skills pool.

Reviewing and, in many cases, simplifying contract management procedures, such as contract documents and specifications, can encourage firms to enter the market, as can improvements in the timeliness and reliability of payment procedures. Increasing use of private firms will increase the contracting authority’s supervision and quality control responsibilities.

**African Experiences**

Most countries routinely employ private contractors for road rehabilitation and resurfacing works. The use of contractors for routine maintenance is still uncommon, although the “lengthmen” or petty contractors have been engaged for specific road maintenance activities, including:

- the establishment of a rolling contract system with individual lengthmen recruited from villages along local roads for maintaining some 7,800 km of road as part of the Kenya Rural Access Roads Program.
- The Gambia pilot project, which employed lengthmen and petty contractors for road maintenance works.

In Ghana, contractors using equipment-intensive methods have traditionally been engaged for road rehabilitation. However, small contractors after four months of practical training in labor-based road rehabilitation techniques followed by two months of trial contracts, can each now produce, on average, 2 km of high quality gravel road per month. A total of 19 such firms have been trained in the World Bank/UNDP financed project, executed by ILO. The equipment needed was reduced to tractors, trailers, and compaction equipment. This endorses the general policy of using the private firms to reduce equipment fleets mentioned earlier.

**Appropriate Technology and Local Resource Use**

**Problems**

Although road maintenance techniques and organizations in most regional countries have been geared to equipment intensive techniques derived from construction and maintenance practices in developed countries, constraints on resources and the availability of underemployed or unemployed labor, will often make the adoption of labor-intensive maintenance techniques economic.
Maintenance budgets in most countries have been shrinking in real terms and are causing increasing proportions of resources to be devoted to salaries, with plant and equipment sometimes immobilized due to lack of operating funds.

Greater use of labor-based techniques could lead to cost savings and increased maintenance effectiveness.

There is also much scope for adapting design standards to maintenance operations to take advantage of local capabilities and local materials, thus saving foreign exchange.

Options for Action

Where labor is available and can be motivated at daily wage rates of up to US$4.00, contractor or community/village-based maintenance crews can provide effective low-cost road repair and maintenance. Considerable political commitment to using local resources such as labor exists in most countries, but this needs to be translated into practical administrative and technical programs. In most cases, it is necessary to phase such programs through pilot projects of two or more years. Decentralizing the supervisory, administrative, contracting and payment authority required for increased use of labor-based techniques can often increase the efficiency of such operations. This should be accompanied by staff training, and the setting of standards for labor-intensive road works (tools, equipment and road materials). The availability of local materials—such as timber for bridge-building—can bring about significant savings in foreign exchange.

African Experiences

The evidence from Sub-Saharan Africa increasingly points out that local resources, particularly labor, can be effectively employed for road maintenance and rehabilitation using labor-based techniques. In The Gambia, a pilot project on labor-based road maintenance has used petty contracts and employed lengthmen to carry out measurable activities. The results show that such approaches employing small-scale, village-based contractors (men and women) are feasible and economic. The petty contractors quickly learned the necessary skills and effectively organized a number of workers for the jobs. However, this was possible with the development of simplified procedures for awarding, control, and payment of petty contracts and for monitoring performance and productivity.

Kenya, Malawi, and Ghana have also successfully applied labor-intensive techniques in their rural road rehabilitation programs. In Kenya, labor-based techniques were successfully employed in the Kenya Rural Access Roads Project and the Minor Roads Project. Malawi also presents a successful case of the application of labor-intensive techniques for road rehabilitation in the Government’s District Roads Improvement Program. Ghana is also successfully undertaking labor-based rehabilitation of feeder roads which has completed high quality gravel roads 15% cheaper than by conventional methods, with up to 40% savings in foreign exchange.
Summary

Equipment availability and utilization is low in many equipment fleets in Sub-Saharan African countries—not utilization as low as 20% in some cases. Availability may be good when equipment is new, but declines rapidly as a result of inadequate maintenance, poor spares supply, lack of trained operators and mechanics and appropriate management. Some of the causes of poor equipment performance may be found in general management and organizational deficiencies. These may originate from a lack of qualified and trained staff, a lack of accountability and incentives within the government organization and a weakness in the management information systems that understates the real costs of equipment ownership. In addition, many equipment managers have unnecessary restrictions imposed upon them in contracting repair work, hiring equipment or obtaining urgent spares from the private sector.

Foreign aid can sometimes contribute to equipment management problems by making more money available for new equipment purchases, thereby increasing the fleet size beyond what can be managed effectively. Tied foreign aid and international bidding procedures introduce non-standard equipment into the fleet, creating more spare parts, training, and management problems.

The losses resulting from poor equipment utilization imply that there is an excessive plant capacity. This paper addresses these problems and proposes that:

- the equipment fleet should be of a size and composition that can be properly managed.
- the resources of the private sector should be used to supplement government plant and equipment holdings.
- managers should be given authority to manage the equipment fleet and be accountable for it.
- donors should coordinate their assistance programs to provide a standardized equipment fleet and provide foreign exchange for spare parts purchases when needed.

The main policy issues addressed in the paper to improve equipment management in Sub-Saharan African countries are:

- to let the private sector have a larger role in provision and maintenance of equipment for road maintenance.
- reduce the equipment fleets to a size that can be properly managed.
- donor commitment to a policy of in-country standardization and foreign exchange support for spare parts.

Introduction

Despite substantial foreign aid and technical assistance to the roads sector in Sub-Saharan Africa, the equipment fleets used in road maintenance are not performing satisfactorily in terms of cost effectiveness and quality of service; the capital and the technical advice that have been made available have not been sufficient to bring about needed improvements in performance.

The route to improvement lies through institutional change and the application of new management policies, rather than through the provision of new resources. Policies relating to pricing, cost recovery, organization and the role of the private sector, as well as improvements in management and technical skills need to be introduced to obtain greater efficiency from already existing resources. In general the resources available, in terms of plant, vehicles and workshops appear to be adequate: it is in their deployment that serious deficiencies are evident.

The size of the problem to be addressed is obvious from anecdotal evidence and from what few surveys exist. Throughout the region there are examples of workshops full of broken down or cannibalized equipment, of fleets made up of widely different makes and types, and of shortages and mismatches in the provision.
of spare parts. In Sub-Saharan countries, 60-70% of the equipment may be broken down (e.g., Southern Sudan, Tanzania).

In others, because of spares shortages or management problems, only 50% of available equipment is serviceable. And because of inadequate operator training the plant that is used often operates at only 60% or less of normal efficiency and work-rate. This means that a significant part of the investment in plant, plus a similar proportion of the investment in workshop tools and support equipment, are non-productive in terms of actual work on the roads. It is not unusual to find that only 20% of total fleet strength may be actually working on the roads at any given time.

In financial terms this represents wasted investments of the order of US$2.5 million per annum for every US$10 million worth of plant in the region. Most of this wastage is in foreign exchange; if the equipment that actually works on the roads was managed effectively much of this wasted investment could be released for alternative development programs requiring scarce foreign exchange.

A 20% utilization implies that the investment in plant is either much bigger than is necessary or that the fleet is bigger than can be successfully managed with the available resources. Either way the economic losses from having fleets larger than can be managed effectively are enormous. Table 1 shows the economic losses incurred per annum at different rates of utilization and fleet sizes. Road maintenance budgets in most African countries are seriously inadequate; effective management of plant could release funds from within these very tight budgets to spend on materials and labor, the other major elements of road maintenance expenditure. An alternative way of illustrating the major financial gains to be realized from good equipment management is to show the hourly costs of owning various types of equipment at different levels of utilization (Table 2). The difference between the 1000-hour utilization rate (good) and the poor and very poor utilization rates common in Sub-Saharan Africa represent the losses due to underutilization, on an hourly basis. The economic life of these machines should be between 8,000 and 10,000 hours: at current rates of utilization most of these machines will be redundant or obsolete well before they reach the end of their economic life.

Tackling the Problem

The large financial returns that can be achieved by introducing effective plant management are not achieved easily. Experience has shown that they depend upon institutional and managerial changes that are often difficult to introduce, for they require the abandonment of profoundly entrenched biases in governments towards public ownership and administration of equipment fleets.

The principles to be followed in addressing the problems of equipment management through institutional reform are the following:

- the fleet should be of a size and composition that will allow proper management.
Table 2. OWNERSHIP COSTS OF EQUIPMENT (USS) at Different Rates of Utilization

<table>
<thead>
<tr>
<th>Equipment Description</th>
<th>Annual Costs</th>
<th>Ownership Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>250 hr. p.a.</td>
<td>500 hr. p.a.</td>
</tr>
<tr>
<td></td>
<td>V. Poor</td>
<td>Poor</td>
</tr>
<tr>
<td>Relative Utilization Rate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Angledozer Cat D6D</td>
<td>30,900</td>
</tr>
<tr>
<td>2</td>
<td>Angledozer Cat D8L</td>
<td>73,300</td>
</tr>
<tr>
<td>3</td>
<td>Wheel Loader Cat 2m3</td>
<td>15,700</td>
</tr>
<tr>
<td>4</td>
<td>Heavy Grader Cat 16G</td>
<td>60,200</td>
</tr>
<tr>
<td>5</td>
<td>Heavy Grader Cat 14G</td>
<td>41,000</td>
</tr>
<tr>
<td>6</td>
<td>Maint Grader 120G</td>
<td>22,900</td>
</tr>
<tr>
<td>7</td>
<td>Tipper Leyland 7t</td>
<td>9,700</td>
</tr>
<tr>
<td>8</td>
<td>Tipper Leyland 5t</td>
<td>8,500</td>
</tr>
<tr>
<td>9</td>
<td>Landrover pickup</td>
<td>5,500</td>
</tr>
<tr>
<td>10</td>
<td>Road Roller 12t dead wt Aveling Barford D0012</td>
<td>10,330</td>
</tr>
</tbody>
</table>

- the private sector resources should be used to supplement government holdings of equipment fleets.
- funding arrangements should be secure and should take into account real costs.
- managers should have the authority to take decisions and should be accountable for them.

**Fleet Size and Composition**

Fleet managers need to make fundamental decisions on fleet size and composition from which other considerations will flow, on the relationship with the private sector, on the establishment of workshops and spare parts inventories, and on staffing. Many mechanical departments have large, aging fleets of heterogeneous origin that cannot be run or serviced economically. It is a recipe for low utilization, high costs, and low standards of service—in short, a recipe for poor output and for the low morale that follows and compounds it. The cardinal principle is to retain a fleet of a size that can be managed using available resources of staff, funding, and support services. It is pointless to retain 60 graders when only 20 can be serviced and kept available, yet there will be resistance to disposing of units that cannot be properly maintained. On the one hand, government procedures for the "boarding" and disposal of vehicles may be cumbersome and designed more to prevent fraud than to facilitate disposal; on the other, there is a natural tendency within ministries to accumulate rather than divest assets. The result is that many ministries have a fleet of plant and equipment that will never operate effectively but simply clog their workshops and make expensive and extensive demands on their service organizations.

It is incumbent on fleet managers first to study the demand for vehicles and plant from their "customers", the users, and then to take a decision on what proportion of the demand they are likely to be able to meet economically using their own resources. This assessment, balancing demand against resources, workshop support, spare parts supply, management skills, and trained operators and mechanics will result in a decision on the size of fleet that can be operated with reasonable economy. No larger fleet should be maintained.

In coming to a decision on fleet size the managers will have to take into account the effect of composition and age. Fleet composition should be determined essentially by the needs of the user, by the advantages of standardization, and by the availability of after sales service from suppliers. Too often fleet composition is determined by aid donors, whose procurement policies are designed with the needs of their domestic suppliers in mind, rather than effectiveness in the hands of recipients—hence, the familiar sight in Sub-Saharan Africa of machinery of many different origins, much of it supplied as part of past highway construction schemes. This creates a considerable burden for the hard-pressed fleet managers, who try to provide spares and train operators, not for one type of grader or dozer with an effective local agent, but with three or four types, some with no agent within thousands of kilometers. It takes determination and considerable diplomatic skill to re-
fuse machinery when offered free with an aid package. However, if it is not refused standardization will not be achieved and the cardinal objective, that of establishing a fleet of a size and composition that can be economically run and maintained, will elude the fleet managers.

It is equally important to have a reasonably young fleet. The corollary of this is that old units must be scrapped, and a clear policy of scrapping when units reach a certain age must be adopted. It is impractical to expect a maintenance workshop to keep an aging fleet on the road without enormous expenditures of time, facilities, and spares. When a ten-year old machine is overhauled, it still remains a ten-year old machine. Although most of the wearing parts will have been replaced, the stresses and misalignments introduced in other assemblies will continue to create a condition of unreliability when full power is restored to the machine. It is therefore not surprising, based on the experience in many countries, that the availability of equipment falls rapidly with age. The graph on the following page shows data from Botswana typical of the relationship between equipment availability and age.

If a correct decision is made on fleet size and composition, it will be possible to create a virtuous circle: better maintenance/higher availability/higher utilization/more economic use of plant/better cost recovery/increased funds available for support services and training/better maintenance. This contrasts with the vicious circle often seen when a fleet is large, old and heterogeneous: inadequate maintenance/low availability/low utilization/uneconomic use of plant/inadequate cost recovery/lack of funding for training and support services/inadequate maintenance.

Projected Plant Availability

However, a decision to scrap a proportion of equipment units and reduce fleet size to a manageable level brings immediately in its train the question: what if the size of an economically manageable fleet is too small to meet the demands put on it by the road department? This question is almost certain to arise since demands on the roads department fluctuate and are difficult to predict. It is almost impossible to maintain a fleet that could meet all of the roads department’s requirements and still remain economic to operate.

The realistic response to this issue is to treat the government’s own fleet as the ‘core fleet’, and to rely on the private sector to satisfy demand peaks or special requirements. In countries where there is no private sector, this policy cannot apply (even so, there could still be a ‘core fleet’ dedicated to the roads department’s requirements, with additional demand being met by arrangements with other public sector bodies). In countries where the private sector is weak, the ‘core fleet’ would be large. In countries with a strong private sector and a political environment not hostile to concepts of privatization, the core fleet could be small, and in some cases might be confined to emergency and security services only. The concept of a ‘core fleet’, of whatever size, raises the question of the appropriate relationship between the government fleet and the private sector.
Using the Resources of the Private Sector

Once government has decided to use the private sector for equipment provision, there is a range of options open to it, from full-scale privatization of the government fleet to sub-contracting certain maintenance and training functions to the private sector. The pros and cons of privatization, as such, are beyond the scope of this paper, and are essentially a matter for political judgement. Of more relevance is the contracting out of a substantial part of the equipment ownership and maintenance burden. Beyond the use of private sector sources to supply plant at times of overload, it is possible to go further and consign a major and permanent part of the equipment requirement to the private sector; in other words to use the private sector to supply part of the core fleet.

The proportion of the government’s equipment requirements to be met through the private sector is a matter for individual judgement, country by country, and will depend crucially on (i) the strength of the private sector in each country and (ii) the willingness of government to allow public sector activities to be carried out by the private sector. A positive attitude towards private sector involvement can be very beneficial to the total equipment provision effort.

Conditions of employment in the public sector with, typically, job security but low rates of pay, tend to result in a lack of discipline (staff cannot be fired), and low motivation (staff cannot be rewarded with pay increases and performance-related bonuses). It is difficult to sustain a results-oriented management regime under the constraints of such staffing policies.

Secondly, there exists within a competitive private sector a wide range of special skills, equipment and facilities no government organization can maintain at an economic cost. Thus the selective use of private sector facilities can greatly increase the scope and cost-effectiveness of the government fleet.

Use of the private sector can take two main forms:

- where the private sector provides a substantial and defined part of the total equipment requirement, as already described; and,
- where the private sector provides specific services to the government fleet.

In this latter role the private sector can be particularly effective across a whole range of activities, but its effectiveness depends on the willingness of government equipment managers to define their requirements with precision and negotiate contracts to obtain what is required. It may be necessary to introduce some form of regulation into the private sector to prevent abuses, such as overcharging or cartels being formed. Self-regulating bodies, who can speak and negotiate for their members, can also impose the discipline of fair trading on their members—such as associations of equipment suppliers or Chambers of Commerce. Some examples of privately-supplied services which have proven successful in Sub-Saharan Africa are:

- Management contracts: Consultants have been used to provide management and technical assistance services under contract. These services can cover the strengthening of the existing fleet management, workshop management and training. The counter-part training of local managers which goes with such contracts should provide long-term benefits to the organization.

- Maintenance: Regular maintenance contracts at advantageous rates can be negotiated with private sector workshops for certain types or classes of equipment. Similarly, certain specialist maintenance services can often be advantageously contracted out.

- Spare parts supply: Government can insist on a spare parts contract with a supplier when purchasing new equipment, thus effectively ‘hiving-off’ a part of its stores organization into the private sector, saving on its own overheads (stores management), reducing the cost of spares (through agreed discounts), and reducing the amount of capital tied up in the stores inventory.

- Training: The training of operators and mechanics can be carried out by the main equipment suppliers and should be made the subject of a contract at the time of purchasing equipment. Equipment suppliers have a particularly strong incentive to provide such training as they want to see their equipment properly used. They sometimes have very good training facilities both in Africa and in their home countries, which can be considered as an extension of the government’s in-house training facilities.

The general concept of cooperation with private sector equipment suppliers to augment and strengthen a government’s own organization is one which has great potential advantages for the government. However, such a policy must be carried out in an active way, seeking to identify and utilize all the benefits that the private sector can provide. This will require a genuine and sustained commitment by the government.

Often governments prefer direct control and will resist such an approach. They may also be misguided by their present accounting systems which can understate the true cost of ownership by ignoring capital costs, omitting interest charges, and understating or ignoring overheads. When comparing costs with private suppliers these elements are often ignored, as are the taxes levied
on private companies, and an unfair comparison of costs is made. Some examples of currently quoted private and public sector costs are shown in Table 3.

In Lesotho, hire rates are an accurate reflection of actual running costs. The Tanzanian rates are not, and it is doubtful if the rates in Botswana capture all the costs. These figures suggest that the government hire rates frequently carry a large element of subsidy and that the private sector, properly utilized, should not involve the government in higher costs and through owning and operating its own equipment, than it bears.

Funding Arrangements

The key to successful equipment management is proper funding, based on accurate costing. Most of the problems met with in the overstocked and under-utilized equipment pools in parts of the developing world arise from bad accounting and inadequate financial provision. The two are linked. If actual operating costs are not known then financial provision will not be made for them. If there is no secure source of funds then there is no incentive to keep accurate cost records or attempt cost recovery.

It is only when true costs are available to management that it becomes feasible to introduce cost saving measures. For example, it can be shown that it is cost-effective to pay up to 25% more for a machine that conforms to local standardization policy than to accept a cheaper non-standard option.

The most effective way, within the public sector, to encourage accurate costing and adequate cost-recovery is to set up a hire fund through which to finance all equipment operations. In its simplest form a hire fund is a system whereby the user is charged a hire fee which is designed to cover the owning and operating costs of the piece of equipment.

When they are successful, hire funds produce cost consciousness among equipment managers. They also introduce a need in the equipment hire organization to keep all plants in working order so that it is available for hire. The scheme also generates funds for purchasing spares and replacement equipment. Unfortunately, many schemes have failed because they have been pressured to keep their rates down to reduce the cost (or, more accurately, the apparent cost) of road construction and maintenance and thus allow roads authorities to stretch their budgets. Another reason for failure of hire fund schemes is that governments find it difficult to resist using the large balances that often accumulate in hire fund accounts—balances that are needed to purchase replacement units—for other purposes, thus depleting the accounts and making timely replacement impossible. As with other matters connected with road maintenance, the success of a hire fund depends on two factors: government commitment to the concept and determined management.

The hire fund system is the preferred method of financing equipment pools within the public sector because it encourages realistic accounting, accurate cost recovery, and economical management. The heart of a hire fund scheme is its accounting system. The microcomputer has made accurate accounting a good deal easier in recent years, and there are now a number of programs available that make it possible to keep full cost-histories of equipment, item by item, so that hire rates, operating costs and fund balances can be kept continuously under review.

External Funding

Aid-supported projects often appear to succeed in their equipment management because, among other reasons, they have access to foreign exchange and operate fairly standardized fleets of equipment. Access to external funding enables the project manager to airfreight urgent

<table>
<thead>
<tr>
<th>Table 3: HIRE RATE COMPARISON (US Dollars)/Hour</th>
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<tr>
<td><strong>Equipment</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>120G Grader</td>
</tr>
<tr>
<td>D.6 Dozer</td>
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</table>
spares and to circumvent many of the delays encountered with normal government procedures. Furthermore, having a standard fleet of equipment enables the manager to minimize the types of spares carried, the amount of training needed, and investment in stock inventories.

Donors may wish to broaden their support to include the entire roads sector equipment fleet. Their role would then be to aid, encourage, and support the principles of standardization of equipment and to provide foreign exchange to purchase spare parts, either channelled through equipment suppliers in the private sector or directly to the roads agency concerned.

The Accountability of Management

A recent evaluation of workshops in a developing country gave private sector workshops a rating of 75% and government workshops a rating of 35%. These were based on the value of spares fitted and the number of jobs completed under approximately similar conditions. Many, familiar with the problems of road maintenance in Sub-Saharan Africa, will feel that these figures are fairly typical for the region. They indicate not only a lack of financial resources for such things as the purchase of spares, but also deficiencies in management and motivation.

Management and motivation of staff are difficult problems to deal with in public sector plant organizations. Such organizations, when under-resourced are overwhelmed by the magnitude of their operational difficulties—constant cannibalization of equipment, and workshops full of machines that are not going to move for months. This has a damaging effect on the morale of a work force that has been unable to perform effectively because of shortage of spares. In the long term the work ethic is eroded. The problems are largely created by lack of performance-based financial incentives, cumbersome bureaucratic procedures, and by lack of accountability in management.

If management is to be accountable, it must be allowed to make decisions and allowed access to the resources it needs to do the job. These are easy prescriptions to make, but difficult to act on within a civil service environment. However, progress can be made by attending piecemeal to certain aspects of the problem:

Management Systems: Reality is always instructive, and plant managers should have access to information, which they can use to make informed decisions. Management systems must be simple, relevant and clearly understood. Managers need to monitor workshop output, equipment performance, spares turnover, overhead and unit costs, repairs and equipment output. Management also needs to communicate with its work force. Two-way communication is beneficial at all levels; some of the best ideas come from those at the work bench who have a different perspective from that of the manager in his office.

Training: Morale, as well as efficiency, is greatly improved by training. The ability to do a job well helps to develop pride in work and enhances motivation. As a rule of thumb 2% of staff time, as a minimum, should be devoted to training.

Compensation: Although public sector salaries are rarely as high as those in the private sector, it is possible for the public sector to maintain parity if such aspects as pension, job security, leave, and subsidized housing are taken into account. If parity cannot be maintained staff will continually be lost to the private sector. Managers, however well motivated, will not be able to achieve good results with a work force consisting only of those who are unable to get better jobs elsewhere.

Thus, by paying attention to the environment within which a manager works, by providing a clear picture of reality through simple management information systems, by providing continuous access to training both for him and his work force, and by ensuring that compensation packages, taken as a whole, are comparable with those in the private sector, it is possible to create conditions conducive to good management. The fundamental conditions, for the continuation of good management practice are:

- accountability of the manager for his successes and his failures, and
- the freedom to take decisions and to act on them.

The Impact on Road Maintenance

This paper has focused on equipment management, and has sought to draw attention to ways of improving the utilization of equipment through institutional and management change. All of the approaches recommended here have been tried and proved successful in Sub-Saharan Africa. In Lesotho, for example, a program of institutional support and management assistance resulted in an improvement (over a five-year period, 1983-1988) in availability from 44% to 81%, and in utilization from 43% to 70%. A similar program in The Gambia improved both availability and utilization from 50% to 90% in only two years.

Such results can only have a beneficial effect on road maintenance. The spectacle of the district road engineer who is responsible for 500 km of road, yet is only provided with the equivalent of US$5,000 to keep a
fleets of 35 items in good condition is, unfortunately, not unusual. It is no surprise that little of his equipment works, and the road network remains in poor condition.

It would be far better, in such cases, to operate with a core fleet managed within a plant hire fund, thus reducing overhead and improving accountability. To reduce to a core fleet size, some of the items might be sold to the private sector, and then hired back. The effect would still be positive, since the plant would remain within the country, but now within a sector that could find the funding and the incentives to use it efficiently.

In cases where the core fleet is too small to handle the work required, and funds do not allow the necessary hiring, there are a number of options open to a roads department. One possibility is to adopt the same approach to the road network proposed for the equipment fleet: to establish a "core network", or to prioritize the network on the basis of available maintenance funding. Another option is to simplify the equipment used and adopt a different mix of labor and equipment. More labor-intensive methods of construction not only reduce the requirement for equipment; they also provide a more than proportional saving in foreign exchange, since the simpler equipment can often be manufactured locally. A third option is to reconsider the mix of equipment held by the roads department; for example by owning only a fleet of graders and supervisory vehicles, much of the essential routine maintenance activity can be carried out. Tippers, rollers, front-end loaders, etc., could then be hired as and when resources make this possible.

There is, of course, no avoiding the fact that underfunding of road maintenance will hasten the already serious process of deterioration of the road networks in the region. There is no magical solution to problems of lack of resources. The meager resources available, however, could go a great deal further—perhaps twice as far—if they were deployed within an institutional structure that encourage, rather than inhibit, good management.

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Introduction

The effectiveness of road maintenance organizations is impaired by a number of factors which are largely beyond the control of the responsible road maintenance staff.

Figure 1 shows the typical distribution of funds for road maintenance. Figure 1 reflects the current state of the road network in many African countries. A large portion of available maintenance budgets has to be spent merely on keeping the roads in a passable condition. Relatively limited funds are spent on preventive, periodic and routine maintenance. In general, the trend is that emergency activities increase at the expense of periodic and routine works.

Figure 2 shows a typical road maintenance expenditure pattern. The proportion of maintenance expenditure going to wages of permanent staff has grown over the years to the point that this type of expenditure typically represents up to 50% or more of the total maintenance allocations. In lean years when road maintenance allocations are reduced, it is the equipment and running expenses which suffer as the permanent labor must be paid. The result is idle plant and underemployed labor.

Community-based, labor-intensive road crews can provide effective low-cost road repair and maintenance in many Sub-Saharan African countries. Spinning rehabilitation and maintenance off to small contractors and village groups can also reduce the work load of Sub-Saharan African road maintenance organizations trying to cope with diminishing resources and crippling foreign exchange shortages. In several African countries, involving local people in the upkeep of their own roads has improved transport networks while boosting local economies and raising rural skill levels.

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**Figure 1**

**Figure 2**
Establishing a labor-based system is not, however, easy or quick. It requires both political and technical commitment. Planning and testing are needed to discover the right mix of labor- and capital-intensive works for each country, region, and road type. Training is required to develop organizational and supervisory skills to direct a decentralized road maintenance system.

Many African road maintenance organizations are seriously overburdened. While the transport networks for which they are responsible are expanding, shortages of equipment and transport prevent optimum use of their work forces. Resource shortages prevent adequate routine maintenance programs, so that much of the work they carry out involves responding to emergencies, rather than undertaking regularly scheduled preventive measures that have much lower unit costs. Budgets that are shrinking in real terms force an increasing proportion of resources to be devoted to salaries, and equipment must be kept idle to save on operating costs.

This paper argues that labor-based maintenance systems can make a significant contribution to alleviating these constraints. The experience of a number of Sub-Saharan African countries (see attached case studies) shows local labor, organizations and skills can increase the effectiveness of maintenance while lowering its costs.

The Scope for Labor-Intensive Maintenance

Labor-based road maintenance and rehabilitation can be technically feasible, cost effective, and extremely reliable in most African situations in which terrain conditions are not extreme. Its major limitations are labor availability and cost.

Labor-intensive methods are used for three major types of works: routine maintenance by force account or contract (see The Gambia and Kenya case studies); large-scale periodic maintenance, rehabilitation and construction by force account (Kenya) or by contract (Ghana); and routine maintenance by agreement with local organizations (Ghana). Figure 3 shows typical organizational structures for each of these arrangements.

Labor-based force account and contract arrangements have drawn popular and governmental support in many countries, as they combine a number of national development goals by saving foreign exchange, improving transport networks, and providing productive employment, particularly in rural and village areas. The success of arrangements with village organizations depends greatly on local traditions and a community's perception of the gains it will make by maintaining access to transport routes.

The potential gains of using labor-intensive methods should not, however, be allowed to obscure the fact that such systems are not easy to establish and, because of their necessarily decentralized nature, are usually more difficult to administer than systems based on the direct single line of command typical of governmental road maintenance organizations.

Moving to labor-based maintenance and rehabilitation begins with firm policy steps that recognize the gains to be made through decentralization and privatization of large parts of the road repair function. This usually requires devolving significant analytic, supervisory, administrative, contracting, and payment authority from the center to the regional or district level. Training may well be needed to develop the skills needed to carry out these responsibilities. Standards must be set for the sorts of roads and works that will come under the new program, as well as for the types of tools and light equipment that will be needed. The case studies show that a high-level commitment is a necessary first step for making labor-intensive methods work.

Given commitment at the political level, the engineering task of designing and establishing a labor-based maintenance and rehabilitation system begins with the gathering of data on the functions and conditions of the links in the national road network, traffic levels, and the human, material and financial resources available. The analysis should include data on equipment costs, availabilities, and utilization rates and the effects of resource constraints on performance under the existing system. Labor availability—including its seasonal distribution in agricultural areas—skills, productivity, and costs should also be assessed, as should the extent and capabilities of small contractors and grassroots organizations.

A thorough analysis of this data—often supplemented by pilot projects—is needed to find a proper balance among the tasks to be assigned to the parts of a new road maintenance and repair system. Figure 4 shows a decision-making process that can be used to make choices as to what mix of labor- and capital-intensive technologies should be used for individual projects.

In most situations, this data does not yet exist. Road maintenance departments in developed as well as developing countries are generally mission, rather than policy, oriented and little given to analysis of their overall approach or the appropriateness and cost-effectiveness of alternative technologies. Thus, management and staff training in developing new perspectives and analyzing the feasibility and costs of new approaches is often needed. Institutionally, most organizations see little incentive for changing time-honored approaches, particularly when they involve the scope of their command or authority. Again, political commitment to
change must be strong to overcome this tendency toward inertia.

In addition to the ongoing performance analysis described above, information is needed on the capabilities of local organizations and construction firms to make decisions on how they can be incorporated into the revised maintenance system. A system must be devised for programming and controlling these inputs, the types of roads that will be maintained and repaired by labor-based methods, and the timing and levels of maintenance that will be sought from each type of intervention. Much of this information can be assembled by mounting experimental pilot and demonstration projects to test various approaches.

Implementing Labor-Based Approaches

Alternative maintenance and rehabilitation systems based on a maximum use of labor resources must be based on organizational and management structures and principles that are perhaps more sophisticated than those used for equipment-based systems.

These systems and principles need to be developed and established before they are applied on a large scale. A pilot phase of two to three years is indispensable for this purpose. Following the data-collection phase discussed above, policies and procedures need to be developed in six key areas:

- Planning and programming systems
- Disbursement and payments procedures
- Procurement procedures
- Management and control systems
- Technical and organizational training
- The establishment of organizational and administrative structures for a large-scale program.

Efficient and cost-effective labor-based programs may be impossible to establish unless sufficient attention is given to all of these aspects. If, on the other hand, the political and engineering commitment exists to
Figure 4: PLANNING OF TECHNOLOGY CHOICE

Design: Suitable/unsuitable for labor-based approach

- Can change be made?
  - no
  - yes

Site condition suitable for labor?

- yes
- partly

Determine appropriate mix of labor and machine

Is labor available?

- no
- yes

Is labor motivated?

- no
- yes

Assess wage rates and incentive schemes

Can target be met by labor-based methods? (base on actual performance comparison)

- yes
- no

Pilot project

- test

Quality
- Training
- Management

Output
- Plan long term
- Number of workers
- Productivity

- negative

- positive

- negative

- positive

USE EQUIPMENT INTENSIVE APPROACH

- positive
- negative

USE LABOR-BASED APPROACH

- positive
- negative

Make financial and economic analysis of labor-based vs. equipment intensive

(base on results of pilot project)
make the required front-end investment in establishing proper systems and procedures, the experience of a number of African countries has shown that sustainable labor-based systems can be successfully established.

In this context, the World Bank/UNDP financed and ILO executed a project to establish a contractor-based, labor-intensive road rehabilitation system in Ghana. The project began with a two-year pilot phase during which a team of specialists provided extensive training and coaching to government and contractor staff carrying out a set of trial contracts. In each case, four months of practical training was followed by a two-month trial contract period. The lessons learned in this process were then applied to the design of full-scale contracts.

Each of the 19 small contractors trained by this program is now able to produce 2 km of high quality gravel road per month using labor-based methods; on a yearly basis they are able to rehabilitate some 450 km. The contractors produce the roads at a cost 15% below that of the previous capital-intensive crews; perhaps more importantly, the foreign exchange costs of these projects have fallen 40%, as the only large equipment used are tractors, trailers, and compactors.

One key to the success of the program has been increased efficiency on the part of the contractors themselves as a result both of the training and, importantly, the support given them by the public sector through improvements in their cash flows and their supplies of tools and essential materials. Isolating these key areas for improvement was a direct result of diagnosis, practical and needs-driven training, and feedback through the pilot process.

Using village labor for routine maintenance has two major advantages, i.e., the costs of transporting equipment and materials is kept to a minimum, and a feeling of local involvement and responsibility is generated through both the employment opportunities offered local men and women and their ability to experience the value of their work directly in terms of increased access to the national transport network. There are also significant indirect benefits. For example, small tool-making and repair facilities often spring up, generating even more local income, and significant skills and organizational capabilities can be developed.

It is easy, however, to underestimate the amount of preparatory work required to ensure the success of a locally-based routine maintenance system. The key areas mentioned above all need to be addressed to establish a functional organizational structure able to provide essential back-up services in terms of supervision and regular and timely remuneration.

In most cases inputs in the form of money or food will be necessary to establish a continuous and sustainable maintenance system, although they may be minimal if agreements with communities and/or defined village or youth organizations are negotiated. Regular and sustained payment can also be negotiated with individuals or "lengthmen" (who may be grouped together) or through petty contracts.

Experience obtained in Kenya provides a good example of routine maintenance contracts with lengthmen. The Kenya Rural Access Roads Program has established a rolling contract system with lengthmen on some 7,800 km of road. The most important lesson learned from this experience is that the system can effectively utilize locally recruited village labor to maintain rural roads, and that the system is cheaper than conventional approaches both in terms of foreign exchange and cost per km. The degree of effectiveness of the system varies from excellent to average depending to a considerable extent on the level of support provided the lengthmen. The type of support required includes the provision of instructions to the lengthmen regarding the timing and priorities of the different maintenance activities and back-up in terms of timely and regular payment, inspections, and tools replacement.

In 1985 this routine maintenance system was extended to part of the country's classified road network. In 1989 a study was undertaken to investigate a further expansion of the system to cover routine maintenance work on major parts of the classified road network.

In The Gambia, a pilot project on labor-based road maintenance has experimented with petty contracts and lengthmen. Using petty contracts for the execution of different routine maintenance activities has been shown to be particularly promising. The project has demonstrated that it is feasible and economic to contract out maintenance activities such as desilting of ditches, gravel excavation, grass-cutting and materials hauling as long as quantities for these activities are easily measurable. Small-scale, village-based petty contractors without previous experience quickly assimilate the necessary skills to organize a number of workers.

Since most of the routine maintenance tasks are similar to agricultural activities, village workers are already familiar with the work techniques and only require basic instruction on work quantities and quality control to perform satisfactorily. Women, in particular, are very interested in part-time routine maintenance work near their homes and are very conscientious in carrying out their tasks. The crucial issue is to adapt the working environment so that the contractors can perform without constraints and with confidence in the employer.

In The Gambia considerable effort has gone into the development of simplified procedures for the awarding, control and payment of petty contracts, the monitoring of labor productivity in road maintenance on daily and
task-work basis, and the training of government staff in planning, programming, inspection and measurement techniques suited to a petty contract and lengthman approach. The Gambia case study elaborates on these systems and procedures.

In applying any of the alternative options it is crucial to consider how workers and their supervisors will be motivated in the long term. Incentives at all levels must be incorporated as part of the system to make it sustainable. For workers at the village level, incentives may not have to be in the form of money. If there is significant local interest in the road or road section, some assistance in the form of tools, construction materials and supervision may be sufficient to mobilize workers. In these cases, planning and programming assistance can be sufficient to mobilize and direct village labor at specific times throughout the year to bring the road back into a trafficable state. This type of maintenance would therefore be provided not as a continuous low-level routine maintenance input, but rather as a scheduled and directed community input involving a significant number of workers two to three times per year. The purpose of this type of intervention is to put minor access roads back into trafficable state when they are most urgently required. The timing of such interventions should be discussed and agreed upon between villagers and the supervising technical ministry, and depends on technical, economic and social considerations. Naturally this type of maintenance intervention applies primarily to access roads with very low traffic levels and where communities are prepared to provide collective inputs to safeguard their level of access to the main road network. The Ghana case study discusses some preliminary experience with this approach.

Finally, in some cases, local interest may be great enough that financial contributions or local taxes can be negotiated with the local beneficiaries.

In all these cases, it is advisable for a technical line ministry to use local administrations in the setting up and monitoring of locally-based maintenance approaches. An ideal road maintenance system that makes optimum use of available resources would most likely comprise a number of different maintenance alternatives. The optimum maintenance approach for a particular road or section would be determined by factors such as the level of maintenance service required (which would in turn depend on the function and purpose of the road), local interest in the road, the availability of local labor, and the general availability of human, equipment, and financial resources. Figure 3 illustrates a possible combination of approaches for different road types.

In choosing between different alternatives the guiding criterion should be cost effectiveness, i.e., the best results for the lowest cost per kilometer. Maintenance engineers/inspectors should be trained in assessing the feasibility of involving communities in maintenance work. Guidelines should be developed specifying government inputs and community responsibilities for different categories of roads. Proportionally greater community inputs will normally be required in the case of access roads perceived to be of direct interest to the communities. Selection criteria for roads to be supervised and supported by governments should reflect the level of inputs provided by the communities.

The role of the maintenance engineer/inspector is vital in establishing a sustainable local maintenance system. He is the direct liaison between the communities and the responsible government authority. It is essential that he is provided with the means to (i) regularly visit and supervise the village workers, and (ii) follow up on promises of remuneration/incentives made during his negotiations with village committees.

It goes without saying that the personality and motivation of the liaison man is extremely important, particularly during the initial establishment phase of the system. His selection and training should be done with extreme care.

**Conclusion**

It is clear that the utilization of local human and material resources for road rehabilitation and maintenance can be advantageous financially, politically and technically. Locally-based maintenance systems minimize the dependence of maintenance organizations on foreign inputs and foreign exchange. They create much needed productive employment in rural areas as well as local skills and a local sense of responsibility for the road network. Spin-offs of using local resources for road works include the development of the rural economy because of cash earnings of local workers and possibilities for the development of local industry, for example for the fabrication/maintenance of simple hand-tools or local forms of transport.

Such systems cannot, however, be established overnight nor should they be applied indiscriminately. While they can often make a significant contribution to improving the effectiveness of road maintenance, they should be applied as complementary approaches in situations where favorable conditions for use exist.

If the potential of local systems is to be realized, it is necessary:
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- for senior government staff to be able to make rational choices between different approaches based on costs and effectiveness. Facts on the costs and performance of such different approaches need to be known. These facts should be assembled partly as a matter of routine and partly through experimentation. Considerable data on productivity and performance of labor-based approaches is available and can be used as a basis for experimentation.

- for senior and mid-level government staff and, where applicable, contractors to be able to efficiently organize and manage large unskilled labor forces and negotiate agreements with village-based organizations. For this, specialized, practical training is a prerequisite.

- for administrative systems and procedures to be at times modified to allow for the effective functioning of locally-based systems. These systems and procedures should, to the extent feasible, be decentralized to avoid inordinate delays in recruitment, payment, and contract award. Labor-based approaches are very vulnerable to these types of delays.

In terms of policy initiatives this means that a government commitment to utilize locally-available resources must be translated into practical measures that allow such resources to be used effectively. Investments need to be made in training, experimentation, system development and low-cost but specialized hardware. A two- to three-year establishment phase is sufficient to provide a solid basis for a large scale application of these systems. During this period, high-level political support is needed to modify policies and procedures so local systems can function efficiently.
Policy modifications may be required in relation to the establishment of appropriate wage levels for casual construction and maintenance workers, recruitment procedures, conditions of employment, procurement and decentralization of responsibilities for contracting and payment.

As regards the specialist assistance and foreign exchange inputs that will be required for the establishment phase of labor-based programs, the Kenya experience has shown that it is feasible to mobilize substantial funding for this purpose from a variety of donors. The Kenya Government has taken the lead in mobilizing and coordinating a consortium of donors who have continued to support the respective expanding programs over a period of 15 years.

The current policies of donor agencies and financial institutions encourage the development of local skills, the utilization of available resources, and the participation of rural communities in their own development. These policies are in line with the priorities expressed in most national development plans. This implies that in most cases decision-makers will find a fertile ground for the mobilization of external funding and the coordination of the donor community.
Richard H. Neale and Derek Miles

Use of Local Contractors and Consultants

Summary

Road maintenance requires the analysis and solution of a diversity of road deterioration problems, over quite substantial distances and through a varied geological and social landscape. It is argued that local consultants and contractors have the potential to be more effective and efficient than government organizations and foreign firms. If carefully encouraged, local firms would be better suited to finding technical solutions appropriate to local skills and resources, and to manage the work within local commercial, social, and political constraints. This would depend largely upon creating enterprising, problem-solving management cultures, in which management practices are carefully aligned with the local commercial, social, and political environment. Road maintenance would form a basis from which firms could progress to undertake a wider range of work.

Suggested action plans include: encouraging the creation and management of a stable market, within which enterprises can flourish; sensitive management of the necessary organizational changes, especially the transfer of staff from government agencies to the local enterprises; formulation of effective forms of contract; and support for a program of training and consultancy, preferably based on local institutions.

Introduction

In most countries the design and supervision of road maintenance are carried out by government ministries or by foreign consulting firms, with site construction work the responsibility of government employees or foreign contractors. An increase in the use of local contractors and consultants may result in more effective road maintenance and in more general national economic and social benefits.

It is unlikely that the simple act of transferring work from ministries to local firms—from the public to the private sector—will have a magical effect. The practical problems remain the same, although some of the effects may be enhanced or diminished by the transfer from one sector to another. The essential difference is, therefore, one of management. As a broad generalization, local, private companies have simpler objectives than public sector organizations; they have a sharper and more immediate motivation, and are able to operate much more flexibly. These characteristics make them better suited to problem solving; they will be better at "doing more with less" (Willoughby, 1981).

Local firms are generally not sufficiently developed in size, numbers or substance to have a significant effect, and so require an effective program of assistance. Since the objective is to foster development of enterprising, flexible, problem-solving firms it is axiomatic that any program of assistance must be directed towards self-development rather than subsidy and protection; that is, the emphasis of the program should be to reward successful enterprises while providing a minimum level of protection against risk.

There are four elements to be considered in developing a strategy for increased use of local firms:

- the technical aspects of road maintenance, and the managerial implications;
- the potential benefits of the use of local firms;
- the problems and impediments to implementation: analysis of the difficulties which must be overcome; and
- the action plans: recommendations for investigations and initiatives for sustainable development of local firms.
Technical Aspects of Road Maintenance and Managerial Implications

Government road maintenance has to be managed so as to provide an efficient public service. In the case of private firms it has to be managed to produce commercial results.

The geometry of roads makes construction work difficult to manage. A long, thin road site stretched over the countryside is much more difficult to control than a compact building site. Communication and supervision are more difficult, transport of people and materials becomes a key factor, and it is likely that the site will traverse a variety of terrain and ground conditions, and perhaps climatic variations. The social topography will also vary—pastoral, rural, village, urban.

Generally, maintenance work is more difficult to manage than new construction. New construction works are designed to a fairly consistent pattern, and much of the work can be standardized, planned and organized in advance. When roads deteriorate, they do so for a variety of reasons and in a variety of ways. Therefore, the general sequence of maintenance work is: investigate, diagnose, remove any deterioration, and return to original standard (or perhaps a revised standard). Thus, compared to new construction, maintenance work requires diagnostic skills and a relatively broad range of construction skills. The scope for standardized solutions and forward planning diminishes.

Normal maintenance has few technical difficulties. In the case of gravel roads, this involves such activities as periodic regrading, ditching, clearing culverts and so on. Over time this has to be extended to include repair of potholes and minor repairs to structures and culverts and, in badly neglected cases, to substantial renovation with some reconstruction. Paved roads are more durable, prolonging the period before they begin to show signs that maintenance is required. Thereafter, a maintenance pattern similar to that for unpaved roads develops, but the solutions are more technically complex, often requiring substantial items of equipment and non-local materials and more difficult managerial tasks.

In developing countries, which have chronic shortages of many of the basic requirements of road maintenance, these problems may become acute. Technically, local firms who are familiar with this environment should be more efficient than foreign firms; their managers speak the local language, know the local customs, and understand the topography and climate. Also, they will be less constrained in their working practices than government agencies. Routine maintenance should cause few technical problems, and they should be well placed to mobilize local resources. Restoration of badly deteriorated roads presents more of a challenge, and should present good opportunities for local consultants to use their skills and local knowledge to produce effective solutions within the capabilities of local contractors.

Such strategies are, however, difficult to supervise. When design decisions are devolved, it is difficult to maintain national performance standards. Because the technical problems of maintenance demand some on-site decisions, these problems are, to some extent, common to whatever organization does the work. The response of most government agencies has been to codify their requirements tightly and explicitly, imposing a system of standardization upon designers and constructors. This follows the practice commonly used in developed countries, but in Sub-Saharan African countries this may mean that available resources are concentrated in the maintenance of some roads to high standards, and doing nothing at all for others. When formulating a road maintenance strategy in circumstances where resources are severely limited, it may be that uniform national standards have to be one of the casualties of compromise.

Similar problems arise in the supervision of contractors on maintenance work. It is difficult to specify the work in a way that allows for design flexibility, difficult to measure it, and equally difficult for the contractor to price it. These problems can be overcome, but it is difficult to write contract documents that will provide the client with a sound basis for controlling the work, and yet be readily comprehensible to contractors.

Potential Benefits from the Use of Local Firms

Three quite distinct factors must be considered:

- the transfer of work from government ministries and agencies to private firms—"the efficiency factor";
- the replacement of foreign firms by local ones—"the national development factor"; and
- changing designs and construction methods to suit local needs, skills and resources—"the employment and economic growth factor".

The Efficiency Factor

It is generally recognized that the administration of road management in developing countries by government ministries and agencies could be considerably improved. There are many reasons for this, but as a generalization government road agencies are overstuffed, provide little real incentive for their staff to perform well, work
Richard H. Neale & Derek Miles: Use of Local Contractors and Consultants

according to rigid rules, and ignore or resist local needs and representation, rather than respond to them.

It can be argued that the fundamental structure of such organizations is inappropriate. Usually conceived and structured along the lines of similar organizations in developed countries, they may lack the institutional characteristics essential to achieve good results in developing countries: flexibility of approach, a positive and innovative problem-solving management culture, and incentives to do more with less.

By contrast, the private firm has simple objectives (survival, profit, growth), recognizes the need to motivate its staff to perform well (and has the means and flexibility to do it), and—being market orientated—is used to responding to local needs, provided that response is commercially profitable.

It is likely that local contractors and consultants could do a better job than government organizations using directly employed labor. Flexibility of action, and the ability to respond to problems, may well produce better results than inflexible governmental organizations trying to satisfy a diversity of influences. In short, the private firm is motivated to succeed, and therefore is likely to find imaginative ways to overcome obstacles to success, whereas the governmental organization may be principally concerned with the application of standard procedures, to avoid taking risks and making mistakes.

The National Development Factor

The arguments for replacing foreign firms with local ones are more clear-cut, and less controversial. First, it is a simple matter of national development to encourage national professional and industrial growth. Strengthening the professions is one of the key factors in increasing the use of local contractors and consultants. Professionally qualified people are a very scarce resource in Africa. Governments and aid agencies devote much time, effort and money to education and training programs to relieve this shortage. Unless those who benefit from such programs find stimulating and challenging work at home, they will either perform ineffectively or find work abroad, leaving their countries more dependent on foreign expertise.

Secondly, and equally important, local firms are likely to be more effective technically—effectiveness being judged on the basis of producing solutions to road maintenance problems with a minimum consumption of scarce resources such as plant and equipment, imported materials, and skills possessed only by a small minority. By contrast, foreign firms may be constrained to apply standard solutions, designing and building to codes of practice chosen because their technical staff are familiar with them although they may be technically inappropriate.

The Employment and Economic Growth Factor

The main thrust of this argument is the prodigious capacity of construction work to create low-skilled employment. The International Labour Organization has been one of the leading organizations in promoting this approach to construction, through the implementation of labor-based road construction projects, and by producing appropriate literature (Edmonds and Miles, 1984, and Allal and Edmonds, 1977).

In summary the potential benefits for using local contractors and consultants are likely to be:

- Political: a clear commitment to national development, promoting economic growth, professional development and employment, and reducing dependency on imported goods and services;
- Economic: the economic benefits stemming from the above political commitment and the inherent benefits that accrue from a better road system; and,
- Cultural: stimulation of education and training, and the development of professions and professional institutions.

Problems to be overcome

The main problems to be addressed in the promotion of local contractors and consultants are:

- Creation of the market: an “enterprise culture” cannot be driven, it must be stimulated by market forces.
- Control: it is difficult to simultaneously promote initiative and maintain control, particularly with respect to construction quality control and cost of works carried out by contractors.
- Effects of organizational change: redundancies or overstaffing in road agencies; staff compelled to undertake tasks for which they are not qualified; and the reality of local business practices.
- Time frame where there is little existing local capacity, the time required to see the results of policies which encourage more use of local firms will be very long.
Creation of the Market

It is clear from the various studies that have been done on the state of local contracting and consultancy capacity that it is generally very weak and fragmented (World Bank, 1988, Edmonds and Miles, 1984). This is an indication that the market for construction design and contracting services does not provide a suitable commercial environment within which local firms can flourish. Some possible reasons for this and the effects on the proposed use of local firms are discussed below.

Political philosophy and structure. One of the most important factors in the creation of a domestic contracting and consultancy capacity is a stable market, otherwise there may not be an "enterprise culture" and much would have to be done to create an environment which encourages people to become entrepreneurs. This may imply that some substantial change is required in the basic philosophy of the government.

Donor policies. Aid tied to the use of goods and services from the donor country is common, and often has the effect of limiting the market for local firms to that of suppliers of local services as subcontractors. Furthermore, the requirement that plant and equipment has to be acquired from the donor country creates a severe problem of maintenance. Countries, receiving aid from several donor countries acquire such a diversity of machines that training their mechanics to be proficient in repairing all of them, and holding sufficient spare parts, become impossible. Similar problems arise if the aid agency insists on international tendering for equipment. This process is in complete contrast to the management practices of major international contractors, who rank standardization very highly in their list of purchase criteria.

Clients' requirements. Technically complex or large-scale projects are generally not suitable for design and construction by small under-capitalized local firms. Usually, the technology is too advanced, or the scope too wide, or the risk too great given their experience and skills.

Form of contract and contract documents. The form of contract is often derived from those used in international contracts, or in developed countries. Usually, this requires a level of commercial sophistication, risk-taking, and contract administration that most local firms cannot meet. The contracts are usually heavily weighted in favor of the client, usually the government.

Uncertain payments. It is common for Sub-Saharan African governments to manage their cash crises by delaying payments to consultants and suppliers. This can be disastrous for small, fragile businesses. Contractors find it difficult to obtain credit, and suffer severe operating problems if they do not have a regular and adequate cash-flow. This situation offers a significant comparative advantage to strongly-capitalized multinational construction enterprises (Lemunge, 1980).

Fluctuating work load. In most Sub-Saharan African countries the funds allocated for road maintenance will fluctuate from year-to-year, sometimes quite widely.

Control

In any project, there are three elements to be controlled: quality, cost and time. To control these elements, project managers need information, knowledge, skills, authority, technical and management systems and resources. Generally, in Sub-Saharan Africa, there are shortages of all these except, perhaps, authority. One result is that local professionals feel disadvantaged in comparison to their foreign counterparts, and so lack the confidence to build their own businesses and compete on equal terms. A further factor that undermines confidence is that information and knowledge acquired from developed countries is much more highly prized than that which relates to local conditions. Thus a strong initiative is required to "localize" education, training and professional development. Good systems for drafting contract documents, contract administration, and the control of payments are crucial to effective control of maintenance and construction work. A contractual system that has simple requirements, simply stated, and capable of simple measurement, is a better foundation for control than a legally complex document employing sophisticated concepts and measurement systems. Much work remains to be done on this problem.

Consultants, who design and supervise, have traditionally been separated from "contractors", who construct what the consultant has designed. Many construction clients throughout the world are moving away from this traditional form of three-cornered adversarial relationship. Control will be more easily exercised if road maintenance contracts are structured in such a way that encourages client, designer, and constructor to work together towards a common purpose.

Effects of Organizational Change

It is likely that greater reliance on local contractors and consultants will require expansion of existing firms under the new stimulus; inducement mechanisms to encourage the transfer of government staff to existing firms; and inducements for complete units of government staff to create firms. The staff of government organizations that might become redundant as a result
of contraction of government activities may be classified as follows:

- Potential design consultants: the more technically able designers, those with some flair and confidence in their own ability, and also those who have good relationships with such people in the private sector;

- Potential contractors: the more enterprising of those members of staff who have been involved in the supervision of construction, who have good contacts in both client and contractor organizations, and who will be prepared to move with them;

- Younger people, who have no special leaning, but who will be reasonably adaptable anyway;

- People in neither of these three groups, but who would be useful members of staff of a much reduced road agency whose purpose was constrained to overall road transport planning, and the employment and control of design and supervision consultants; and,

- Others, whose skills and attitudes would not make them easy to fit into any of these new positions.

Assuming that the organizational changes were managed effectively, with sensible inducements, there should be only real problems with the last class of employees. Thus the magnitude of the problems under this heading will be directly related to the number of people in this last class. A careful study must be done of the way in which local firms really operate within their own commercial and social structure. Generally, individuals will have strong social and cultural identities, beliefs, motivations, and obligations within social systems that have developed over centuries. These may be principally those of familyhood, tribe, and a complexity of other influences. Business practices are likely to be more strongly related to the parameters of these systems than to Western microeconomic theory. Perhaps, if all the determinants were clearly understood, the theory would still apply. It is necessary, therefore, to conduct serious research to identify and understand these parameters.

Development strategies such as "the introduction of modern management practices" must be viewed with some concern. What is needed is a careful study of existing management practices—which may work reasonably well if the economic context could be improved—and then to work with local people to improve them. Obviously, a relatively large number of firms will be more difficult to control than a few larger ones, so this is another crucial issue.

Time Frame

It has been shown that local consulting and contracting capacity in Africa is, generally, weak (The World Bank, 1988a and Edmonds and Miles, 1984a). The Road Deterioration Study (World Bank, 1988b) indicates that most government organizations are overstaffed and that their equipment is underused. Thus a policy of transferring work from the government organizations to local, private, firms would have the effect of moving the work from a sector of the economy that has surplus capacity to one with inadequate capacity. It is likely that a well-managed program for the development of local firms will increase the capacity of this sector—supported, of course, by more general development programs that stimulate the expansion in numbers of educated and skilled people. However, this natural growth will have a very long time frame, so more immediate action will have to be taken to transfer significant numbers of government staff to the newly emerging private companies, or to form sections of the organization into new, private firms. Thus, to achieve results in a reasonable time, it will be necessary for the program to incorporate a large component for accelerating organizational change through intermediary institutions of various kinds.

This problem reflects the growing concern of many officials working for development agencies, i.e., the time frame of many projects is far too short. The working environment for many projects in the Sub-Saharan African Region are such that projects take time to mobilize and mature, and this period would be usually much longer than the two or three years that is usually allowed.

Action Plans

The purpose of these action plans is to suggest, in broad terms, what investigations and development programs will be necessary for the effective development of local design and construction firms. The prime concern of such programs will be to foster the development of organizations which have determined, enterprising, and problem-solving management cultures. Logically, this must begin with the development of the market.

Market Development

Work must be made available to firms in a form that they can do without undue strain, within an acceptable level of risk, and within the knowledge, information, skills and resources available to them. This has technical implications, requiring a move towards
Richard H. Neale & Derek Miles: Use of Local Contractors and Consultants

smaller projects (or the subdivision of large ones) based on local technology, and using appropriate construction techniques.

Unless and until the market for road maintenance becomes stable, with a sufficient and foreseeable annual demand, it would not be prudent for firms to concentrate solely on maintenance work. For most firms some diversification into related forms of construction activity will be necessary, so the program must take a broader view. Maintenance work should be seen only as a good basis for new firms to establish themselves and for existing firms to develop.

External support for the program should be aimed at stimulating enterprises, rather than at protection. The introduction of stabilizing measures, such as funding that would provide an assurance that an adequate number of projects would be available regularly over a substantial period of time, with timely payments, can help reduce risks.

Given the difficulties that local firms face in getting finance and credit, some form of assistance will be necessary. This need not be in the form of subsidies, grants, or soft loans, but simply a system of making finance and credit easier to obtain. Typical financial and other constraints faced by small-scale contractors seeking to establish themselves in the construction market, as well as experience in measures to overcome them, are discussed in the ILO publication "Guidelines for the development of small-scale construction enterprises" (ILO, 1987).

One of the main problems is that construction is perceived (frequently correctly) by most commercial banks as a high-risk business. Routine road maintenance contracts should offer a lower-risk entrepreneurial opportunity than new construction, since the work content and hence the cost are more predictable. It is in the interest of clients to ensure that financial risks are minimized by committing themselves to prompt and regular payments. Careful thought needs to be given to devising equitable methods of calculating payments due and ensuring that maintenance contracts are let only when there is a reasonable guarantee that funds will be available to honor payment applications promptly.

Measures to Secure Effective Control

Where road maintenance is executed on a force account basis, control structures are largely internal to the public sector organization which is responsible for setting the task and carrying it out. When private consultants and contractors are brought in, the situation becomes more complex. The potential for an improved and more economical service will only be achieved if simple but effective control procedures are in place. This implies both the development of appropriate forms of contract and training of supervisory staff such as clerks-of-works and inspectors.

A program of research and development into appropriate contract forms is crucial. The World Bank has been particularly active in this area, emphasizing fair contract procedures and its willingness to encourage "slicing and packaging" of larger projects (World Bank, 1986). Road maintenance is intrinsically different from new construction, and further innovation is necessary to formulate a system of contract administration which sets objectives that are easy to perceive and devises ways in which results can be easily measured.

Facilitating Organizational Change

The development of local consultants and contractors should lead to a reduction in the size of government organizations.

One of the difficulties is the transition period, and this may have a fairly long time frame. There are two distinct elements: the "efficiency factor" indicating a transfer of emphasis from government to private firms, and the "national development factor" indicating the substitution of foreign firms by local ones. It may be impractical to work on both of these aspects at the same time, in which case a decision on priorities will have to be made.

The need to study the social and cultural dimensions of development programs has become widely accepted. In a program aimed at mobilizing local contractors and consultants, this element will be vital. It will be necessary to discover the principal motivators of consultants and contractors, what risks they are prepared to take, how do they attract, motivate and control their staff. Equally careful and thorough studies will have to be done to design schemes for the transfer of staff from the government to the private sector.

Institution Building

In a program aimed at finding local solutions to local problems, local institutions obviously can take a major part. Experience has shown that successful Institutional change depends on a concerted action by those involved in the industry—clients, consultants, and contractors. Governments also have a major part to play. As the predominant clients of the industry, governments can take a strong position to promote the emergence of capable and well-motivated domestic construction businesses and consulting firms.
The contribution of local institutions would include:

- research and development projects on appropriate methods of design and construction, leading to more realistic design and better control;
- providing information, advice, and skills through consultancy;
- devising and running effective and practical training programs; and
- establishing a focal point for professional development.

Appropriate training will be essential if customer-oriented attitudes are to be inculcated. The ILO Inter-Active Contractor Training (ICT) methodology (Hernes, 1980) has been designed specifically to encourage owners and managers of small-scale construction enterprises to work with, and learn from each other. Each module of ICT training material contains learning texts, together with worked examples, exercises and simulations to reinforce the learning. There is scope for developing ICT modules to meet the specific needs of road maintenance enterprises, which could be modified by local institutions. This could be supplemented by manuals and handbooks on road maintenance practice, along the lines of the ILO/ITDG manual on building maintenance (Miles and Syagga, 1976).

The ILO has formulated the concept of "Results-Orientated Training Activities" (ROTA), in which short ICT-based training sessions are interspersed with practical implementation under the guidance of experienced advisors. The emphasis is on achieving measurable results through the application of appropriate management skills. It would be possible to take this approach further by adopting a "franchising approach," in which each model enterprise would be provided with a package of managerial tools (such as costing systems) which could be modified to suit individual needs.

Concluding Remarks

This paper has given a broad review of factors that will be important if road maintenance is to be transferred from government organizations to private consulting and construction firms. No specific strategic "blueprint" has been proposed because there is a clear need for more information before this can be done. Technical studies will be necessary to quantify such variables as the potential size of the market and the numbers of professional and skilled people available. Social studies will be necessary in order to ensure that development assistance is designed to provide realistic and acceptable results.
References


Summary

The maintenance of The Gambia's road network is the responsibility of the Department of Technical Services (DTS) (formerly Public Works Department) within the Ministry of Works and Communications (MOWC). The maintenance responsibility of DTS includes all the primary and secondary roads of The Gambia, which in practice means all the paved and gravel roads and certain principal earth routes throughout the country. The network of roads to be maintained by the DTS in 1987 comprises 1,471 km of which 538 km are paved and 933 km are gravel/earth roads.

DTS, with technical assistance from the International Labor Organization (ILO), has since January 1989 carried out a pilot project on road maintenance. This project has been jointly financed by The Gambian Government and the ILO from resources made available by Swedish International Development Authority (SIDA). The pilot project was reviewed in October 1987 by DTS, the World Bank, UNDP, UNSO and the ILO. The participants to the review recommended an expansion of the project to cover some 300 km of roads in Eastern Division.

The pilot project was set up to develop, test and introduce alternative labor-based road maintenance systems on selected primary, secondary and feeder road sections. It was anticipated that a more flexible and sustainable maintenance approach could be developed based on the use of labor with possible savings and fewer operational constraints than the traditional equipment-based system.

The pilot project has experimented with two complementary labor-based systems of routine maintenance for The Gambian road network. Its purpose was to demonstrate the feasibility of achieving routine maintenance using either of the labor-based systems and to furnish productivity and cost data. This would enable an assessment of the cost effectiveness of the systems and their possible role in the future maintenance of The Gambian road network to be made. The results of the pilot project would determine the maintenance strategy to be adopted in the World Bank-financed Second Highway Project.

The systems utilized labor recruited in the villages along the road network. The first system was the lengthmen arrangement whereby a single person is engaged to carry out all routine maintenance on a particular section of road. The second system was that of petty contracts. Under this system one or more routine maintenance activities are contracted to a village-based contractor organizing a group of workers over a longer section of road.

Productivity data for "daywork" and "taskwork" conditions were assembled during the pilot project. A comparison of the two alternatives shows a significant improvement in output under taskwork conditions ranging from 14% to 137%. Taskwork recommendations for lengthmen and petty contract conditions have been prepared based on the monitoring results of the pilot project.

Systems and procedures for recruitment, payment, contract administration, planning, programming and monitoring, have been developed by the pilot project. These procedures were successfully introduced by the project and have been approved by MOWC.

In sum, the pilot project has demonstrated that unskilled labor can be engaged with no previous experience of road works to carry out all routine maintenance activities except small-scale rescaling. Only the occasionally required inputs of gravel and premix for patching need to be supplied.

The success of the pilot project has led to the development of an expanded project of labor-based road maintenance in Eastern Division. The principal objective of this project is to put into place a cheaper, more easily sustainable maintenance system with a lower reliance on equipment and greater utilization of local resources. This expanded project is viewed as an interim phase to a nationwide application of the systems developed by the pilot project. The project which was scheduled to start in mid-1989 will train for this purpose adequate numbers of supervisory, administrative and operating staff and establish labor-based routine maintenance systems on some 370 km of primary and secondary roads, comprising 25% of the national road network.

Pilot Project Organization

The pilot project field work was organized and supervised in close cooperation with the Divisional Engineer in Eastern Division. The direct field operations which included the daily setting of tasks and monitoring were carried out under the supervision of a UN Volunteer project officer. Pilot project field staff included 2 supervisors, 1 tractor operator, 1 driver and supporting administrative staff. The project was regularly guided and supported by short-term consultancy inputs and monitoring visits.

Project equipment included handtools, 1 pick-up, 1 tractor, 1 towed grader unit, 2 trailers, 2 bicycles and various miscellaneous items. A detailed tools and equipment list is attached as Annex 1. The tools supply covered the project requirements for some maintenance workers over the pilot project period (two years).

The project establishment phase comprised the procurement of project equipment, the setting-up of project store and office, the assignment and briefing of project counterparts staff and the carrying out of a detailed road inventory. This phase was followed by a productivity monitoring period of 10 months during which basic productivity data for each maintenance activity have been established.

Following a review of these phases during which the forms of contracts and the specification for petty contracts were finalized, the maintenance activities were extended to cover all project roads using lengthmen and petty contract methods. During this final period a towed grader team was also trained and its performance monitored. A pilot project work plan is attached as Annex 2.

Data Collection and Works Control

Inventory. The purpose of the road inventory was to establish the pertinent details of the sections of road to be maintained to assist later in recording data and planning maintenance work.

The following basic data were recorded in tabular form for each road to the nearest 0.1 km:

- Features
- Junctions
- Villages (both on and close to the road)
- Culverts and structures
- Ditch requirements
- Existing gravel pits
- Surface type
- Pavement width
- Dates and details of periodic treatments (gravelling/resealing/overlay).

The inventory was used to divide each road into sections of approximately 5-6 km in length (2-3 km either side of each village). The beginning and end of each section was established on the road with a permanent mark (e.g. marker posts, stakes).

Condition and Works Inspections. The purpose of these inspections was to determine for each section of road:

- the annual routine maintenance requirements for each maintenance activity for planning purposes;
- the condition of the road for works programming purposes;
- the maintenance work carried out for works control purposes.

Initial full inspections were carried out on foot by the Project Officer. The Defect Inspection Forms used for gravel and paved roads are shown in Annex 3. These inspections were carried out three times per year. Routine inspections were to be carried out on roads under lengthmen and contractor maintenance by a foreman on the bicycle. The foreman inspected the quality of work done and determined the progress of works. The foreman stayed overnight in village accommodation.

Annex 4 provides an example of a completed daily works report with a detailed explanation on its completion. During the pilot project period, these reports were produced on a daily basis for the monitoring of works progress and the establishment of productivity norms. During the normal maintenance cycle, these routine inspections would be carried out on a monthly basis.

Administrative Systems and Procedures

Recruitment and Dismissal. The MOWC systems of recruitment and dismissal of labor, in use at the time of the start of the project, were very cumbersome and constrained the use of casual or contract labor. Five different documents were involved in the recruitment and discharge of casual labor. Simplified forms and procedures were developed by the project which both satisfied MOWC requirements and which enabled the efficient recruitment and discharge of labor to more closely match the maintenance work load.

Annex 6 contains samples of the recruitment and discharge forms subsequently agreed and used for the casual employment of labor and for the engagement of lengthmen. The new system has worked effectively and has been recommended for adoption by the MOWC for all hiring of temporary labor and lengthmen. Following a reorganization of the MOWC the Divisional
The Gambia: Pilot Labor-based Road Maintenance Project - Case Study

Engineers would have more responsibility for controlling works. The project concluded that the Divisional Engineer should be delegated the authority to recruit and discharge all Daily Paid Labor, including lengthmen, in line with the reorganization's decentralization policy.

**Petty Contracts.** Petty contracts procedures also were complicated and caused lengthy delays in their application. Formal requests had to be approved by the Director of Technical Services and payment procedures were very cumbersome, necessitating the petty contractors to travel to the Ministry of Finance in the capital to collect payment checks.

New forms and procedures were developed at the start of the pilot project. These were agreed with the Director of Technical Services and implemented under the project. The project concluded that under the reorganization the responsibility for awarding petty contracts up to a certain value would be invested with the Divisional Engineer.

The project found that petty contracts were not difficult to control where work could be easily measured, e.g., for vegetation clearing, gravel loading or unloading etc. However, care was required in measuring and controlling certain activities, e.g., gravel excavation. In this case, quantities were required to be controlled in trailer loads or measurable heaps.

The Petty Contracts Forms were completed in three copies:

- one copy for HQ and Ministry of Finance procedures
- one copy for the Contractor
- one copy for Project Officer's file

The Form of Contract included a brief standard specification for each activity to be carried out.

During the period of the contract one visit was made by the foreman or Project Officer to check on progress of the contract if necessary warning the petty contractor of deficiencies or delay and the consequences. On the appointed date the Project Officer inspected the work compliance with the contract.

- On satisfactory completion of the work a Certificate of Compliance was made out in duplicate and issued to the Petty Contractor.
- If the work had not been satisfactorily completed a Notice of Non-Compliance was given to the Petty Contractor stating the reasons for unacceptability. A further inspection date was then stipulated on the notice.

- At the deferred inspection date the satisfactory completion of the work would enable the Certificate of Compliance to be issued.
- If the work was still deficient at this time the extent of work not satisfactorily completed would be measured.
- A Certificate of Contract Variation would be issued stating the reasons and extent of the work to be excluded from payment. This Certificate could form an alternative part of the Certificate of Compliance.

**Payment Procedures.** The main drawbacks of the payment system in force at the time of the start of the pilot project were:

- the frequency with which the checking and approval process had to be repeated and the associated costs, administration and transport requirements;
- the problems of adjusting the actual payment against the time actually worked and the difficulties thereby introduced for work and cost monitoring;
- the need for the casual employee to travel to the arranged paying point at his own cost and inconvenience.

For labor-based road maintenance to be successful it is essential that payment of employees is carried out regularly at the appointed time and place and in the correct amount, otherwise motivation of the workforce will suffer.

In order to allow timely and regular payments the pilot project paid casual laborers on a monthly basis in arrears, to their exact entitlement and on a day fixed to be between seven to ten days into the following month. Then, in order to reduce costs of transport, payment was made at villages along the roads being maintained, which was more convenient for the casual employees. This arrangement significantly reduced the amount of administration work and the amount of travelling. All due payments for days worked and overtime could be finalized before payment processing.

The existing payment provisions for Petty Contractors were totally unsatisfactory. Considerable time and expense tended to be wasted in the contractor travelling to Banjul to receive payment. For this reason arrangements were made so that the payment checks were forwarded to divisional level for payment in cash by the Project Officer, the Divisional Engineer or an approved Paying Officer in the village of the Petty Contractor.

It was ensured that the Petty Contractors were paid correctly and promptly within a reasonable time.
(two weeks) of the certification of satisfactory completion of work.

**Work Methods.** A number of techniques were developed for controlling the quality of work achieved. For reshaping the gravel carriageway by hand, wooden pegs were placed at 3 meters either side of the center line to define the road edge. The pegs were fixed by camber board and spirit level so that the tops of the center line pegs indicated a 4% cross fall to the tops of the carriageway edge pegs. The amount of peg sticking out of the ground was immaterial—the level of differential was the important feature. Material was then reshaped by hand from the gravel surface until the height of peg above the road surface at center line and channel were equal. Light compaction by hand ramming was adopted. Over a period of time the traffic further consolidated the gravel. Any irregularities in the surface could be removed later by only two passes of the tractor towed grader. Similar full reshaping of carriageway using equipment only would have required six to eight passes of a towed or motor grader.

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Table 1: LABOR-BASED PILOT PROJECT PRODUCTIVITY MONITORING RESULTS

<table>
<thead>
<tr>
<th>Activity Code</th>
<th>Activity Description</th>
<th>Unit</th>
<th>Average Work</th>
<th>Improvement Task Work</th>
<th>Task Work Productivity Improvement %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gravel/Paved Roads</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10/20</td>
<td>Cleared vegetation</td>
<td>m²/HR</td>
<td>54</td>
<td>71</td>
<td>31</td>
</tr>
<tr>
<td>11/21</td>
<td>Cleaning culvert</td>
<td>NO/HR</td>
<td>0.21*</td>
<td>0.25*</td>
<td>19</td>
</tr>
<tr>
<td>12</td>
<td>Gravel patching</td>
<td>m³/HR</td>
<td>0.25</td>
<td>0.31</td>
<td>24</td>
</tr>
<tr>
<td>13/23</td>
<td>Miscellaneous</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Gravel patching</td>
<td>m³/HR</td>
<td>0.51*</td>
<td>0.58</td>
<td>14</td>
</tr>
<tr>
<td>15</td>
<td>Ditch clearing</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15A</td>
<td>Ditch result</td>
<td>M/HR</td>
<td>6.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15B</td>
<td>Ditch excavate</td>
<td>M/HR</td>
<td>1.42</td>
<td>3.36</td>
<td>137</td>
</tr>
<tr>
<td>16</td>
<td>Light grading</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Reshape by hand</td>
<td>m³/HR</td>
<td>5.3</td>
<td>9.2</td>
<td>74</td>
</tr>
<tr>
<td>Paved Roads</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Premix patching</td>
<td>m³/HR</td>
<td>0.06</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Patching shoulders</td>
<td>m³/HR</td>
<td>0.17</td>
<td>0.37</td>
<td>118</td>
</tr>
<tr>
<td>25</td>
<td>Regravelling shoulders</td>
<td>m³/HR</td>
<td>0.33</td>
<td>0.60</td>
<td>82</td>
</tr>
<tr>
<td>29</td>
<td>Small surface resealing</td>
<td>M/HR</td>
<td>10.6</td>
<td>12.0</td>
<td>13</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>100C</td>
<td>Exc + stockpiling</td>
<td>m³/HR</td>
<td>0.20</td>
<td>0.31</td>
<td>55</td>
</tr>
<tr>
<td>100D</td>
<td>Loading gravel</td>
<td>m³/HR</td>
<td>0.53</td>
<td>0.87</td>
<td>64</td>
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<tr>
<td>100E</td>
<td>Unloading gravel</td>
<td>m³/HR</td>
<td>1.06</td>
<td>1.62</td>
<td>53</td>
</tr>
<tr>
<td>201</td>
<td>Premix manufacture</td>
<td>m³/HR</td>
<td>0.19*</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* 6 M width gravel pavement
### Table 2: ROAD MAINTENANCE ACTIVITIES
#### RECOMMENDED TASK WORK RATES

<table>
<thead>
<tr>
<th>Category Rate</th>
<th>Activity</th>
<th>Code</th>
<th>Task per</th>
</tr>
</thead>
<tbody>
<tr>
<td>manday</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gravel/Paved Roads</td>
<td>Clearing vegetation</td>
<td>10/20</td>
<td>420m²</td>
</tr>
<tr>
<td></td>
<td>Clearing culverts incl.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Inlets + outlets</td>
<td>11/21</td>
<td>1-2</td>
</tr>
<tr>
<td>NO</td>
<td>Gravel patching (manual)</td>
<td>12</td>
<td>1.8 m³</td>
</tr>
<tr>
<td></td>
<td>Miscellaneous patching (spot regravel)</td>
<td>13/23</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ditch desilt</td>
<td>14</td>
<td>3.5 m³</td>
</tr>
<tr>
<td>LIN.M</td>
<td>Ditch excavate</td>
<td>15B</td>
<td>20</td>
</tr>
<tr>
<td>LIN.M</td>
<td>Light grading (tractor)</td>
<td>16</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Reshape by hand</td>
<td>19</td>
<td></td>
</tr>
<tr>
<td>Paved</td>
<td>Patching shoulders</td>
<td>24</td>
<td>2.2 m²</td>
</tr>
<tr>
<td></td>
<td>Regravel shoulders</td>
<td>25</td>
<td>3.5 m³</td>
</tr>
<tr>
<td></td>
<td>Small surface reseal</td>
<td>29</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Shoulder reshape (hand)</td>
<td>32</td>
<td>70</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>Quarry prep (vegetation)</td>
<td>100A</td>
<td>250m²</td>
</tr>
<tr>
<td></td>
<td>Quarry prep (overburden)</td>
<td>100B</td>
<td>2.5 m³</td>
</tr>
<tr>
<td></td>
<td>Exc + stockpiling gravel</td>
<td>100C</td>
<td>1.8 m³</td>
</tr>
<tr>
<td></td>
<td>Loading gravel</td>
<td>100D</td>
<td>5.0 m³</td>
</tr>
<tr>
<td></td>
<td>Unloading gravel</td>
<td>100E</td>
<td>10.0</td>
</tr>
<tr>
<td></td>
<td>Aggregate transport</td>
<td>203</td>
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</tbody>
</table>

It was found to be essential to control the excavation and desilting of ditches by a template. Without this daily control the quantity and quality of work suffers significantly. The towed grader was found to be completely satisfactory for light grading and corrugation removal; two passes—one each side—were normally sufficient to achieve this. However most of the pilot project roads had not been previously regraded for some years and had acquired an inverse camber. The major reshaping required has not been done over the full length of the project roads. However, it has proven feasible to reshape sections of road using eight passes of the towed grader. The machine was able to take off four to five cms of material at one pass and redistribute it.

Bitumen patching premix material was prepared using labor to mix by hand. It was also prepared at various points on the road network where a concrete base had previously been prepared to facilitate mixing. Screening
laterite gravel was used due to the absence of cockle shell aggregate. The bitumen cut back (SC800) was heated by firewood in a half barrel and applied to the correct amount of aggregate (measured by wheelbarrows). The materials were mixed using long-handled spades frequently heated in the fire to facilitate mixing. The material was supplied to the lengthmen who cleaned out the potholes, filled and compacted the material with hand rammers to repair the road surface. The slow curing cut back allowed up to three days for placing the material before unacceptable stiffening.

Pilot Project Results

The detailed productivity monitoring of the different labor-based maintenance systems was carried out on a total of 63 km of bitumen and gravel road.

Lengthmen operations were established on 44 km of bitumen and gravel road and carried out Petty Contracts on a further 19 km of gravel roads. It was demonstrated that unskilled labor can be engaged with no previous experience of road works to carry out all routine maintenance activities except small-scale resealing. Only the occasionally required inputs of gravel and premix for patching need to be supplied.

Productivity data was assembled for work carried out under "daywork" and "taskwork" conditions. For the daywork situation the labor outputs for a fixed eight-hour day were measured. Using this data tasks were set based on the eight-hour quantities. The time to complete the task was then measured. The equivalent hourly productivities were determined and averaged for each activity.

The task work recommendations have been used to derive proposed petty contract rates. Details on the method of price determination and rates proposed for each routine maintenance activity are contained in Annex 8. Page 2 of this annex also details the rates already accepted under the Pilot Project for Petty Contracts.

Conclusions

It is becoming increasingly evident that major problems are being experienced in implementing road maintenance by equipment-based force account methods, particularly in more remote rural areas.

Availability rates for equipment and transport are extremely low and this negatively affects the performance of permanent maintenance workers. It appears to be fundamentally unsound to transport difficult-to-motivate-and-control unskilled labor, with equipment expected to be available less than 50% of the time, with transport cost and travelling time penalties, to work on a section of road where there are equally competent village laborers who are willing to work hard for a supplement to their subsistence income and on a payment by results basis.

MOWC in The Gambia has now decided to take the groundwork of the labor-based pilot project and over a timescale of say five to six years, work towards an integrated road maintenance system that:

- makes maximum use of labor-based lengthmen and petty contracts as opposed to force account for routine maintenance work;

- minimizes reliance on transport and sophisticated equipment.

The range of routine and periodic maintenance activities required to be carried out by the MOWC are detailed in Table 3. The methods for implementing each activity under the proposed medium-term strategy are listed. Basically it is recommended that nearly all routine maintenance activities are carried out by lengthmen or petty contracts supervised by foreman on motorcycles. Payments will be made either on the specific roads or at certain population centers/road depots. This strategy would significantly reduce the requirement for tipper trucks and only slightly increase the demand for supervision vehicles for payment duties.

A much smaller direct labor or force account core would be retained at the Divisional Engineers HQ/Main Depots with arrangements for them to be temporarily accommodated at other sub-depots within the division as necessary (by the payment of appropriate allowances).

These one or two gangs per division would be equipped with a tipper truck, be deployed anywhere in the division and be responsible only for:

- emergency works
- patching of bitumen roads
- premix manufacture for patching
- small-scale resealing
- pavement reconstruction
- pavement regulation

Should be carried out by centrally controlled (MOWC HQ/DE) equipment-based teams deployed as necessary on the road network with adequate servicing and repair back-up. Motivation could be similarly improved by the use of productivity related allowances.

In the long term, serious efforts should be made to encourage a local contracting capability to carry out some of this periodic maintenance work with sufficient numbers of contractors to avoid monopolistic situations. Hauling, patching, and regravelling would be most suitable to this approach.
Table 3: ROAD MAINTENANCE IMPLEMENTATION
PROPOSED MEDIUM TERM STRATEGY

<table>
<thead>
<tr>
<th>Code</th>
<th>Maintenance Activity</th>
<th>Proposed Method</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gravel Roads</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Clearing vegetation</td>
<td>Lengthmen/Petty Contract</td>
</tr>
<tr>
<td>11</td>
<td>Clearing Culvert Drainage</td>
<td>&quot;</td>
</tr>
<tr>
<td>12</td>
<td>Gravel Patching (manual)</td>
<td>&quot;</td>
</tr>
<tr>
<td>13</td>
<td>Miscellaneous (Emergency Work)</td>
<td>D E Mobile Gang</td>
</tr>
<tr>
<td>14</td>
<td>Gravel Patching (Spot regravelling)</td>
<td>Lengthmen/Petty Contract</td>
</tr>
<tr>
<td>15</td>
<td>Ditch Cleaning</td>
<td>&quot;</td>
</tr>
<tr>
<td>15A</td>
<td>Ditch resilt</td>
<td>&quot;</td>
</tr>
<tr>
<td>15B</td>
<td>Ditch Excavate</td>
<td>&quot;</td>
</tr>
<tr>
<td>16</td>
<td>Light Grading (2-4 passes)</td>
<td>Towed grader team</td>
</tr>
<tr>
<td>17/19</td>
<td>Reshaping Roadway</td>
<td>Lengthmen/Petty Contract</td>
</tr>
<tr>
<td>18</td>
<td>General regravelling</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paved Roads</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Clearing vegetation</td>
<td>Lengthmen/Petty Contract</td>
</tr>
<tr>
<td>21</td>
<td>Clearing culvert drainage</td>
<td>&quot;</td>
</tr>
<tr>
<td>22</td>
<td>Patching premix</td>
<td>D E Mobile gang</td>
</tr>
<tr>
<td>23</td>
<td>Miscellaneous (emergency work)</td>
<td>&quot;</td>
</tr>
<tr>
<td>24</td>
<td>Patching shoulders (manual)</td>
<td>Lengthmen/Petty Contract</td>
</tr>
<tr>
<td>25</td>
<td>Regravelling shoulders</td>
<td>&quot;</td>
</tr>
<tr>
<td>26</td>
<td>Pavement repairs</td>
<td>Mobile bitumen team</td>
</tr>
<tr>
<td>27</td>
<td>Mowing</td>
<td>Delete</td>
</tr>
<tr>
<td>28</td>
<td>Regulating pavement (premix)</td>
<td>Mobile bitumen team</td>
</tr>
<tr>
<td>29</td>
<td>Small surface resealing</td>
<td>D E mobile gang</td>
</tr>
<tr>
<td>30</td>
<td>General resealing</td>
<td>Mobile bitumen team</td>
</tr>
<tr>
<td>31</td>
<td>Fog seal</td>
<td>&quot;</td>
</tr>
<tr>
<td>32</td>
<td>Shoulder reshaping by hand</td>
<td>Lengthmen/Petty Contract</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Miscellaneous</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100</td>
<td>Stockpiling gravel</td>
<td></td>
</tr>
<tr>
<td>200</td>
<td>100A Quarry preparation:</td>
<td>*Lengthmen/Petty Contract</td>
</tr>
<tr>
<td></td>
<td>vegetation clearing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>100B Quarry preparation:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>overburden removal</td>
<td></td>
</tr>
<tr>
<td></td>
<td>100C Excavation and stockpiling gravel</td>
<td></td>
</tr>
<tr>
<td></td>
<td>100D Loading gravel</td>
<td></td>
</tr>
<tr>
<td></td>
<td>100E Unloading gravel</td>
<td></td>
</tr>
<tr>
<td>201</td>
<td>Premix manufacture</td>
<td>D &amp; E mobile</td>
</tr>
<tr>
<td>202</td>
<td>Cockle shell agg.proc.</td>
<td>Contract</td>
</tr>
<tr>
<td>203</td>
<td>Aggregate transport</td>
<td>Regravelling</td>
</tr>
<tr>
<td></td>
<td></td>
<td>team/contract</td>
</tr>
</tbody>
</table>

* Equipment-based for periodic maintenance work.
Introduction

A substantial component of the World Bank's Fourth Highway Project in Ghana concerned the rehabilitation and maintenance of feeder roads. In light of accumulated experience elsewhere and the known employment situation, a labor-based approach was proposed. The private sector was to be involved in preference to the more traditional direct labor (force account) approach to rehabilitation.

For the development of maintenance strategies, the project aimed to mobilize local communities adjacent to the roads based on the tradition of free community labor for local development projects. Where possible, the communities were also to undertake "Spot Improvements" to render local roads accessible where the rehabilitation program was not reaching.

The government organization responsible for the project was the Department of Feeder Roads (DFR) within the Ministry of Roads and Highways (MRH). To provide the Technical Assistance required for the specialized nature of the project, the UNDP agreed to fund a number of Technical Advisers, based both at the DFR head Office and the chosen project areas. The Government of Ghana was to provide the local costs and the initial funding breakdown was as follows:

<table>
<thead>
<tr>
<th>Source</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>World Bank (IDA)</td>
<td>US$4.64 million</td>
</tr>
<tr>
<td>UNDP</td>
<td>US$0.98 million</td>
</tr>
<tr>
<td>Government of Ghana</td>
<td>US$1.55 million</td>
</tr>
</tbody>
</table>

A number of preparatory missions were carried out by officials and consultants representing the World Bank and the International Labor Organization (ILO), the chosen executing agency for UNDP. The ILO has been extensively involved in the development of the labor-intensive technology in the construction field. As a result of these studies, the project was based in the Western, Brong Ahafo and Ashanti Regions, which are the main cocoa producing areas of the country. In these regions, the steady deterioration of the feeder roads has led to severe problems in the evacuation of cocoa for export. One district in each of the three regions was chosen to form a contiguous geographical area (Sefwi Wiawso, Goaso, and Bekwai).

The two main field components of the project were based at:

- Sefwi Wiawso - rehabilitation by contract
- Kumasi - spot improvement and maintenance (SIAM) (to cover the Sefwi Wiawso, Goaso and Bekwai Districts).

At each place, a Technical Adviser was based and, at Sefwi Wiawso, a Training Adviser was responsible for the contractors training program. Local counterpart staff were appointed from within DFR, which also provided all other necessary support staff for the field activities.

The Chief Technical Adviser was based at the DFR Head Office. His terms of reference were to assist in the establishment of the capacity of the DFR to plan, monitor and control labor-based feeder road improvement and maintenance programs.

Establishment of the Program

Before the arrival of the Technical Assistance team, a number of preparatory activities were undertaken by the DFR staff. The principal ones were:

- initiation of procurement of construction equipment, tools, office equipment supplies and vehicles.
- initiation of the building of the necessary infrastructure (accommodation, classroom and training facilities, workshop and stores, offices) at Sefwi Wiawso.
- inventory of all feeder roads in three project districts.
- socio-agricultural analysis of the areas of influence of the roads.
- priority ranking of the roads for the initial roads rehabilitation programs over a three year period.

In addition, the ILO organized during this preparatory period study tours for the designated Project Engineers to countries where successful labor-based programs
were operational (Botswana, Ethiopia, Kenya, and Malawi).

The procurement of appropriate tools and equipment was based on a project analysis by the ILO. The requirements were incorporated into the World Bank Staff Appraisal Report for the Fourth Highway Project in May 1985.

The procurement procedures followed World Bank Guidelines for both International Competitive Bidding and International Shopping, and were directed by a Project Management Unit which had been established for the Fourth Highway Project. DFR provided a counterpart engineer to gain experience in the procedures. Two ICB documents were produced, one through Ghana Bank for Housing and Construction (BHC) for the equipment intended for the contractors (paragraph 3.1), one through DFR for use on the SIAM component where the Department was to retain ownership.

Young engineers of the DFR, including two designated Project Engineers for the Contracts and SIAM components, carried out the roads inventories over a period of several months. The existing road lengths, drainage structures and other engineering features were recorded together with social amenity data such as schools, clinics, markets, etc.

The newly established DFR Planning Unit, headed by a Planner from the University of Kumasi (UST) compiled data on village population agricultural activity, social amenity, and specifically, cocoa production in the project areas. From this data, a priority ranking system was produced using weighted parameters.

Towards the end of the preparatory period, in April 1986, ILO representatives ran a number of seminars to introduce the project. The seminars were held in Accra and in four towns in the project areas, Takoradi, Sefwi Wiawso, Goaso and Bekwai. The participants included both local administration representatives and the local contractors who were being encouraged to join the program. At this time, an assessment of these contractors was carried out in order to define the training needs of the companies. Subsequently, an outline training program for contractors and government staff was produced.

Following the explanatory seminars, the contractors were invited to express their interest in joining the project, initially in Sefwi Wiawso. Twenty-one firms applied and a selection procedure was carried out with the following as principal criteria:

- relevant previous experience;
- creditworthiness; and
- ability and willingness to provide and pay for supervisory staff to be trained by the project.

**Program Implementation:**

**Contracts Components**

A selection exercise was carried out to choose an agreed eight firms for the initial training program. An initial four sets of equipment had been included under the project funding. The intention was to identify the four best companies after training to continue with the contract work. The initial selection of eight firms was done by assessment of a completed questionnaire which provided both technical and financial information. The technical assessment was carried out by DFR and the financial clearance was given by BHC. Small companies, locally based and with a previous record of satisfactory work for the DFR were sought.

The cost per set of equipment was approximately US$150,000. The second purchase order replaced the tipper truck by a pick-up type vehicle.

The field work started with a detailed training program covering a 23-week period. The initial theoretical (classroom) training was kept to a minimum. The main emphasis was on practical experience through rehabilitation of a 10 km road close to the project field offices as a model training site.

Each contractor was required to send four trainees (engineers or technical supervisors) and to provide all costs in connection with the training. Once trainees were working on the model road they were paid at the appropriate rate for the job to relieve the contractor of part of his financial responsibility.

Together with the contractors' trainees, the DFR provided an equal number of engineers and foremen (some from the SIAM component) for training. These would later be deployed in supervision roles on contracts or for the organization and management of the SIAM program. Training was directed by the ILO Training Adviser.

The training program and model road were completed on schedule during a period of four months. As a second stage of the training program, the four best performing firms were awarded 5 km sections of road as Trial Contracts for DFR to assess their individual capability. During this period, project staff acted in both a supervisory and advisory capacity. The contract periods were four months with contractors—each using one set of equipment which they would take over at a later stage.
Equipment Arrangements

As noted (paragraph 2.2), the procurement of the equipment for the use of the contractors was undertaken by the BHC, with the objective of the Bank entering into hire purchase agreements with the chosen contractors for repayment over a four year period. The loans were evaluated in dollar terms at a fixed interest rate of 20%. Monthly repayments were due in local currency at the prevailing exchange rate, which was floating.

Before committing untrained contractors to these loans, the DFR agreed to lease the plant during the model road and trial contract periods (total eight months). For the model road, the Government bore the costs and for the trial contracts, equipment costs were deducted from the contractor payment certificates. Appendix 1 shows the charges made to the contractors during this period.

The BHC conducted its own assessment of each contractor's financial credibility before entering into the loan agreements. On satisfactory completion of the trial contracts, the loan agreements were signed and the equipment handed over to the contractors.

Contract Procedure

The normal procedure for DFR at the start of the project was to award contracts to selected contractors using the Department's standard unit rates and including a variation of price clause. These rates were based on capital-intensive technology and related to the use of heavy earth moving equipment.

During the construction of the model road, the project staff analyzed the productivities and costs for the various work items as carried out by a labor-based methodology and calculated appropriate unit rates. On the assumption that productivities obtained on the model road with its highly concentrated supervision would not be reached under normal contract conditions suitable adjustments were made to the rates to be applied for the trial contracts and subsequently, the full contracts. Appendix 2, prepared by DFR project engineer shows the unit rates used by the project.

Full contracts of 25 km were then awarded to each contractor for completion in one year. For these contracts, the standard conditions of contract used for roadworks in Ghana were applied, but for the labor-based contracts a number of special conditions were added specifying the plant and working methods to be used. Appendix 3 shows these additional clauses.

In addition, a payment system was introduced to try and ensure that labor was paid fully and promptly at the end of the each month. Advance payments for labor were made at the end of each month, based on returns submitted by the contractor, before the monthly measurement of work was undertaken. These advances were then deducted from the normal interim certificate payments. Supervision staff monitored the payment of the laborers in the initial stages.

Project Extension

Based on the initial results of the training phase and the obvious competence and commitment of the contractors, the Government and the World Bank decided to expand the project from the original four contractors to nineteen. This involved the organization of two more training courses each with staff from six firms and selected engineers and supervisors from DFR. Each course trained some fifty staff. The new firms were chosen from the Brong Ahafo and Ashanti Regions in order to be able to expand the project areas. Eventually for the second course, two extra contractors from the Eastern Region were added for a proposed project in that area. The total number of firms trained by mid-1989 would, therefore, be twenty-one.

Costs

The cost of rehabilitation works by contracts using this technology were running about 20% cheaper in financial terms than the equivalent capital-intensive work being done for DFR. In addition, the foreign exchange component is now reduced by about 50% from around 60% to around 30%. At 5 m, graveled width (10 cm compacted), with full length longitudinal drains and with new culverts at 1.6 no/km, the budget cost of rehabilitation is now put at US$10,000 per km. It is of interest to note that these costs are lower in US Dollar terms than initially calculated. The reduction in dollar costs was mainly due to the devaluation of the Cedi against the dollar which made equipment more expensive and labor less expensive in dollar terms. Appendix 4 shows the achievements of the contract component as of August 31, 1988, in terms of length completed and costs.

Work Load

In order to retain the interest of the contractors and to ensure the ability to repay the equipment loans, a consistent work load has been ensured for the immediate future. Under the World-Bank financed Cocoa Rehabilitation Project, 3,000 km of feeder roads have been earmarked for the labor-based program. This proportion will be increased, if necessary.
Ghana: Feeder Roads Project - Case Study

Project Implementation: Spot Improvement and Maintenance Program (SIAM)

Introduction

The emphasis of the Spot Improvement Maintenance Program was to involve local communities in the improvement and maintenance of their own feeder roads. The objective of the spot improvement work was to render roads at least passable most of the year by the improvement (usually to the drainage) of those spots preventing access. The installation or repair of culverts, the raising of low areas and the rehabilitation of steep sections were the main elements. Strategies were then to be evolved for the routine, recurrent and periodic maintenance using communities and DFR force account labor as appropriate.

A thorough inventory carried out by the project staff revealed that very few roads were in a maintainable state and that the spots to be improved were far more numerous than envisaged with about three times more culverts than programmed.

Being a new concept, the idea had to be explained and "sold" to the local administrations and communities. In the areas chosen for the start of the operations, much time was spent at the village level holding explanatory meetings and discussing the strategy for mobilizing the necessary free labor. Whereas the tradition is for the communities to give its labor freely on one day in the week, the essence of this program was to try to spread that large labor force over the five-day period into more manageable units.

At the same time, the idea of providing some incentives to individuals and/or the communities to encourage the free labor input was explored with the World Food Program (WFP), which was already involved in food aid distribution within the entire DFR organization. Food aid inputs to SIAM eventually commenced in September 1988.

Spot Improvements

Short spur roads were chosen in each of the three project districts as model spot improvement sites. Spot improvement work was carried out during the period of June to August 1987. The response from the villages varied considerably after the initial promises of full cooperation.

Two out of the three roads (Bekwai and Goaso) were eventually completed successfully with the standard of work being good. However, it was clear that the work input required had been too high to be able to sustain the enthusiasm and commitment of the workers over the long period. The third road (Bibiani), although substantially completed suffered considerable problems with mobilization and local politics. Continuous liaison was maintained with the local administration at district and village levels and with all the traditional mobilization authorities, but with no consistent success.

Future Strategy

In order to program the work and allocate resources effectively, consistent work force and good productivity were required. By the very nature of free labor, neither could be guaranteed for a long period and progress was slow. Following this experience, it was decided to scale down the size of future spot improvement operations and not to involve the communities for longer than a two month consecutive period. In this manner, spot improvement by a free community labor was still considered a viable operation since several communities made specific requests to project staff to be included in the program.

Maintenance

Routine maintenance can only be carried out on roads that are maintainable—meaning that they do not require improvement or rehabilitation to bring them to an acceptable standard. Such roads were rare within the project areas. Eventually, the program established routine maintenance on:

- roads rehabilitated under the contract component;
- roads improved under spot improvement;
- roads rehabilitated under the DRR capital intensive program; and
- roads reshaped under SIAM recurrent maintenance.

The project evolved a strategy of establishing road maintenance committees at district, zone and village levels to be responsible for routine maintenance of feeder roads, with DFR providing necessary tools and technical supervision. This fitted in well with the Government policy of decentralization, which had led to the election of local district assemblies in the 110 political districts in the country. This shift to local responsibility away from central government facilitates considerably the practical organization of involvement in road maintenance. Initial results obtained with this system are encouraging.

Recurrent maintenance remains with the DFR labor force and consists of two elements:

- light grading and reshaping using the towed graders; and
mobile culvert maintenance gang.

Two types of towed graders are being used on the project, the mechanical and hydraulic models, which are being compared in performance.

The culvert gang consists of a foreman, artisan, and laborers based on the tipper truck which carries a tent, materials, and tools sufficient for one week's operations. Desilting, inlet/outlet, clearing and ditching are carried out by the laborers while the artisan completes headwall, wingwall, and apron repairs.

The periodic maintenance of regraveling is let out on contract to those contractors trained under the labor-intensive program. This will be another element in the future work load for those contractors.

Lessons Learned

The ability of small contractors to efficiently apply labor-based road rehabilitation methods has generally exceeded expectations. Small firms, initially lacking technical expertise and resources have wholeheartedly embraced the technology. Clearly, they see in it a steady future work load with proven profitability, taking into account overhead and loan repayment obligations.

Productivity is constrained by a shortage of trained supervisors, a minimum of five per contractor is needed if the optimum labor force of 200-220 is to be employed. One or two contractors are falling below the target of 2 km per month on the full contract with a labor force of 160-180. Once fully equipped, the 19 trained firms have a capacity to produce over 450 km of high quality gravel roads per year.

The long training and trial periods are necessary to prove the competence and commitment of the contractors. There was an initial concern that contractors only saw the project as an opportunity to get some equipment after which they would disappear. This fear was totally unfounded. Applications from other contractors to join the program have exceeded fifty. There are a number of small contractors headed by a qualified (degreed) engineer. These are, not surprisingly, among the best performers and account is taken of this in the selection procedure.

The involvement of other agencies in aspects of the project (e.g., BHC for procurement and loan agreements) has a serious delaying effect. For them, the project naturally does not have the same priority as for DFR. In general, procurement is very time consuming. It should be given full-time attention well in advance of project implementation. Specialist inputs for procurement should be part of the project.

The question of mechanical backup in an otherwise mainly "civil" project should be thoroughly addressed. The small amount of backup equipment for hauling, compaction and supervision is absolutely essential, and measures should be taken to ensure a reasonable availability of these items.

Particular attention should be given to the less "glamorous" project components such as routine maintenance organization. Project components such as SIAM are more difficult to establish because results in organizing and mobilizing community workers are much harder to achieve and less visible.

Government departments, such as DFR, are generally overworked and understaffed in normal circumstances with a significant gap at middle management level. A newly-funded project not only adds to the general work load but imposes new management and administrative requirements which staff have to assimilate. It would be advantageous to initially establish a separate unit within the Department for such a project. If this is done, care should be taken that such a unit offers adequate career possibilities to senior and middle level staff. If this is not the case, attachment to such a unit would quickly be perceived as a punishment rather than as an enhancement of a personal career.

Technical assistance is often confined to senior levels only. On this Project, the value of U.N. Volunteers at the field implementation level has been proven and an extension of this to the SIAM component has been recommended to help the young DFR engineers day-to-day involvement with the communities.

The enthusiasm of most communities to provide access on what they perceive to be "their own roads" (i.e., single short spurs) is clearly evident. Turning that enthusiasm into effective practical action and long term sustainability is difficult where the labor is to be totally free and some form of incentive scheme should be considered. The community-based approach to routine maintenance needs to be very flexible with no system "imposed." This is where the village maintenance committees have an important role to play.

The rapid expansion of the program has a number of important implications in terms of funding and management. The DFR management capacity in contracts administration, planning, accounting, procurement and mechanical support has to be strengthened proportionally with the program expansion. Systems for inputs deliveries (financial and material) and management information are essential. In terms of cash flow, the large-scale application of labor-based contracts creates growing financial obligations which may cause considerable problems unless timely measures are taken. The establishment of a sufficiently substantial revolving fund covering two months of project operation is a prerequisite for the continued success of this program.
In 1974, the Kenyan Ministry of Works initiated a program of feeder road improvements. The program was directed at farm to market roads and the intention was to provide a stimulus to agricultural production. It was designed to cover the populated areas of Kenya. Its original target was 14,000 kms over ten years, although this was subsequently reduced to 8,000 kms in light of the decline of the economy.

In its objectives and scope, the program was no different from a whole variety of others that were implemented in Africa during the 1970s. They reflected the belief in the catalytic nature of rural roads and the concern to increase agricultural production. Nevertheless, this program—the rural Access Roads Program—was different in one fundamental aspect. It was designed to be implemented by labor-based methods.

This could have been surprising enough in a country with some previous experience of these techniques. In a country which was not lacking in donors ready to support programs and with little knowledge of the use of the methods, it was a major political and philosophical commitment.

That this commitment was justified is shown by the fact that ten years later, the program had:

- constructed some 7,800 km of gravel road at an average cost of some US$6,000 per km;
- created temporary employment for over 14,000 people per year;
- created permanent employment for another 4,000; and
- produced roads of an acceptable and satisfactory quality.

At its peak, the program was producing over 1,200 kms per year in 42 districts throughout Kenya.

While the program was a success in producing good quality roads at a reasonable price, it also had other indirect benefits.

Firstly, between 55-60% of the total cost was in local currency, much of this in wages, which was investment in the rural areas. A similar equipment intensive program would have spent only 10-15% in local costs. This therefore represented a foreign exchange savings of 40-45% for every dollar expended.

Secondly, it provided the model for the replication of labor based projects elsewhere in Africa and Asia.

Finally, it illustrated the possibility of effective donor coordination.

Since its inception, the program has attracted a great deal of financial and technical support. The latter has been provided in the belief that this kind of program would be implemented elsewhere and that the RARP could serve as a model of implementation. That this has indeed been the case is illustrated by the enormous interest that the program has generated during its implementation. In 1988, pilot projects or programs based on the concepts developed for the RARP were being implemented in thirteen African and six Asian countries.

In the RARP, the development of local resources was emphasized. There was a high involvement of local personnel. The training of the supervisory personnel was specifically related to the management of large numbers of workers.

Furthermore, new planning, programming and organizational procedures have been developed. Research was carried out on tools and equipment to improve their quality.

Decentralization of planning was realized by delegating the responsibilities of the initial screening and selection of the access roads in their respective areas to “District Development Committees.” Consequently, the rural communities at the grass-roots level have been involved in the identification of the roads to be constructed. The selection of these roads was done in accordance with guidelines established by the Roads Department of the Ministry of Works.

What were the major factors that contributed to this successful program?

Government Commitment. At the time of the start of the program, the Kenyan economy was just beginning to suffer the effects of the oil crisis. Nevertheless, foreign exchange was still available, and rural under-
development and rural-urban migration were not seen as major development issues. It took a far-sighted government, therefore, to see the potential benefits of a program which relied on local resources and created employment in the rural areas. Moreover, the proposed program was not one that would automatically appeal to the implementing agency. From the beginning, however, the government was prepared to put its own funds into such a program. On average, about one-fourth of the total RARP budget of US$50 million has been provided by the government.

Training. Even before the program was initiated in the field, training programs had been set up for the supervisory staff. Correctly, the MOW had judged that the effective supervision of the labor force would be the critical element of a labor based program. A specialist training unit was set up and over the life of the project, a total of some 300 supervisors have been trained.

The training program had several critical elements:

- it was set up early enough to ensure that efficient staff were available at the right time;
- it was institutionalized within the MOW; and
- it conducted a series of refresher courses to ensure that staff were constantly up to date.

The training center has been used as a regional center in that many other countries have sent trainees to the center.

Systems and Procedures. There was a recognition from the start that a smooth change of technology to labor based methods would require modifications to existing systems and procedures. This applied both to the technical aspects of design, appropriate tools and equipment and construction procedures as well as the administrative aspects such as procurement, recruitment and payment. The MOW established a technology unit whose job it was to advise the Ministry on the effective implementation procedures it needed to adopt.

Among the variety of aspects the unit tackled, the following is a small sample:

- a system of payment ensuring that workers were paid on time at the site;
- a procurement system which ensured that good quality hand tools were obtained;
- Definition of specifications for tools and simple equipment;
- a planning and reporting system which permitted effective monitoring of the program; and
- construction procedures adapted to use of labor based methods.

The value of the planning or technology unit cannot be underestimated. Introducing a new technology automatically presents problems of adaptation. Equally, program management rarely has the time to devote to anything else but implementation. The capacity which such a unit offers to analyze and propose solutions is particularly useful.

Donor Support/Coordination. From the start, the program had strong donor support. Over the ten-year period, the RARP has received support from ten different donors. This, of course, has been very welcome and has permitted the RARP to grow to such an extent. On the other hand, each donor had different objectives and procedures. If the MOW had to deal with all ten donors separately, service ten different review missions, and provide information to ten donors separately, the MOW would scarcely have had time to run the program.

Early in the life of the program it was believed that it would be much more sensible to have a coordinated donor group which, to the extent possible, would provide a common approach to the program. The donor group met once or twice a year with the Ministry to share problems and to discuss the future of the program. Such donor coordination, which it should be said is relatively rare, had specific advantages:

- it reduced the time spent by MOW officials dealing with donors;
- it provided a common approach by the donors to the program;
- it limited the more eccentric demands that donors placed on the Ministry; and
- it ensured that "a problem shared was a problem halved", ("or tenthed").

District-Level Selection. Linked with the political support was the manner in which roads were selected for improvement. This was carried out not at the headquarters in Nairobi, but at the district level by the local council. Clearly, no system is without some possibilities for patronage or nepotism. Nevertheless, the selection procedure adopted was such that the local people had the impression that the roads were not imposed from
the center, but came from a local selection process. The process also involved a consideration of whether sufficient people were available and willing to work on the particular road.

Maintenance. It is little use improving roads if they cannot be maintained. The RARP developed a system of lengthen maintenance which utilized laborers who had worked on the road for the maintenance. In this case, the laborers had more affinity with the road and, while there have been certain modifications that needed to be made, the effect has been generally good. In addition, the system has provided employment on a full time basis to over 4,000 workers.

Endnotes:
1. A set of equipment consisted of the following items:
   - 1 tipper truck
   - 3 tractors
   - 6 non-tipping trailers
   - 2 pedestrian vibrating rollers
   - 1 water tanker
   - 1 water pump
   - 1 chain saw
   - 1 set of handtools

2. A District Development Committee comprises representatives of the various ministries, the local government and members of parliament.

Topic B: Case Study

Kenya: Rural Road Maintenance

This case study relates to the system developed for the labor-based Rural Access Roads and Minor Roads Programs in Kenya. The study draws heavily on reports produced by the Ministry of Public Works in Kenya.

Background

The Kenyan Ministry of Public Works (MOPW) initiated the Rural Access Roads Program (RARP) in October 1974. By the end of 1986, approximately 8,000 km of rural access roads had been completed and the majority of them gravely and brought under maintenance.

Consideration was given to various ways of maintaining the completed rural access roads and a "lengthman-contractor" system was chosen because it was labor based and the most appropriate. The alternatives considered included the traditional MOPW equipment based practice, and the possibility of recruiting a group of casual laborers two or three times a year to carry out the maintenance under the direction of an overseer equipped with a vehicle, caravan and mobile store. However, the costs, logistics and management problems of these alternatives weighed against their adoption.

In the lengthman system, an ex-construction worker was contracted for a section of road, typically 1.5-2.0 km in length. He was provided with hand tools and supervised once a month by an overseer to monitor the condition of the road and to authorize payments for satisfactory work. The payment was based on the contractor carrying out twelve days of work per month on days of his selection. The contractor could be replaced if he consistently performed badly.

The contractor would live adjacent to the road and would, therefore, not require government accommodation or transport as these consume considerable resources in a traditional equipment based maintenance system.

A principal attraction of the system is the comparatively low level of equipment requirement and consequently, fewer support problems. This is coupled with a low foreign exchange component of the system which in 1982, was estimated to be only 10%. This compares with a typical foreign exchange component of equipment based routine maintenance systems of 50%.

The system also enables maintenance to be achieved throughout the year on each section of road.

The lengthmen system also creates productive paid employment in rural areas where there are few opportunities for such work. The contractor is able to live at home with his family, and the part-time terms give him the opportunity to work on his own land as well. The ongoing program, the Minor Roads Program, presently employs 5,500 people on routine maintenance.

Unfortunately, the establishment of the maintenance system did not attract the same amount of research and development effort as the construction aspects of the RARP had done. It was assumed that the local administration and people would bring pressure on the contractors to maintain "their" roads at a good standard, however, this assumption was incorrect. The needs for training and supervision were underestimated with the contractor’s appreciation of the maintenance requirements being rather taken for granted. The consequences of mechanical problems associated with the supervision vehicles had an adverse effect.

It is now realized that the development of effective maintenance systems requires as much, if not more, effort than construction.

The problems of this maintenance system are:

- it is easy to underestimate the level of supervision required;
- the assumption that peer group pressure will be brought to bear on the contractor is generally incorrect;
- supervision requires mechanized vehicles which need proper maintenance and repair; and
- it is necessary to define a series of maintenance tasks related to the time of year, rainfall, soil type and level of traffic.

In addition, it was necessary to determine maintenance...
Kenya: Rural Road Maintenance - Case Study

resources requirements and systems for their development, direction and control. Arrangements for dealing with urgent works such as washouts and culvert breakages needed to be formulated. The methods of identifying spot regraveling and full regraveling needs required to be developed and the various options for carrying out this work, e.g., by animal drawn haulage, casual labor or small-scale contractors, needed to be investigated. There was a need to ease the supervisory burden of the maintenance overseers in relation to the time that they could allocate to each contractor and the mechanical problems of their vehicles. The scope for the use of headmen needed to be developed and did the methods of training, directing and monitoring them.

On the technical side there was the aspect of maintaining a satisfactory longitudinal profile, especially for the minor roads. There was also the question of safety for lengthmen working on the carriageway of the more heavily trafficked roads. Consideration needed to be given to the use of simple tractor drawn mechanical graders or drags for maintaining the running surface in these circumstances, with pothole patching support and all off-carriageway work being done by the lengthmen.

A more equitable and effective system of recruitment, control, censure and replacement of contractors needed to be developed.

**Maintenance Strategy**

The system presently operational in Kenya is based on the following strategy.

The main objectives of maintenance of rural access (i.e., unclassified) roads and minor (i.e., ADT less than 30 V.P.D.) roads are:

- to provide an all weather vehicular access at a level of service commensurate with the role of the road; and

- to preserve the initial investment in the road.

The deterioration characteristics and maintenance requirements of earth and gravel roads are very different from those of bitumen roads. By comparison, bitumen roads represent a far greater capital investment and, despite being normally subject to higher traffic loading, their rates of deterioration are usually much slower. This allows more time for inspection and identification of maintenance needs, and the planning of works implementation.

On the other hand, feeder roads can deteriorate very quickly—in a matter of months—without proper maintenance. Bitumen roads can remain serviceable from one year to the next with little maintenance intervention, especially in the early and middle life of the pavement. Their maintenance requirements can be identified and planned years ahead with modern survey and management techniques. A further feature of bitumen roads is that for a given section of road, the maintenance requirement is substantial and needs to be implemented quickly for minimum traffic disruption and maximum safety considerations as compared to feeder roads or Low-Cost/High-Maintenance roads.

The whole approach to the planning and organization of maintenance of feeder roads, therefore, needs to recognize these essential differences.

The policy of adopting the lengthmen system attempts to tackle the fundamentally different requirements of feeder, as against bitumen roads.

The aim of the system is to provide a constant maintenance presence on the road able to react to the priorities of routine maintenance as they arise.

The lengthman approach compares well to the traditional equipment-based system in terms of physical output, a motor grader may produce a slightly higher standard of running surface immediately after grading the road, however, the surface deteriorates at an increasing rate until the following grading—which is often not achieved until twelve months later—when the road has reached a very poor condition. It usually necessitates heavy grading to rehabilitate the surface. This means that average condition of the road under the lengthman system can be considerably higher with attendant vehicle cost benefits.

From the discussion above, it follows that a maintenance system for feeder roads should:

- make the maximum use of casual labor in the vicinity of the road;
- enable planning of routine and periodic maintenance and their accommodation within the budget provisions;
- require the minimum of form filling, reporting, and administration commensurate with good planning and control;
- be less sensitive to the availability of supervision vehicles;
- enable effective control of the lengthmen in their work output and quality;
- enable formal or on-the-job training to be carried out for all levels of personnel compatible with their background, previous experience and understanding of maintenance.
Kenya: Rural Road Maintenance - Case Study

**Periodic Maintenance**

The RARP/MRP programs are using a periodic maintenance system based on regraveling utilizing tractors and trailers. This has provided an effective system which utilized the same equipment that has been so successful in the improvement works.

**Costs**

As presently constituted, the costs for maintenance of the lightly trafficked rural access roads and the more heavily trafficked minor roads using the labor based system were as follows:

- **Routine Maintenance**
  - Rural Access  220-280 KL*/km/year
  - Minor Roads  260-320 KL/km/year

- **Periodic Maintenance**
  - Rural Access  250 KL/km/year
  - Minor Roads  340 KL/km/year

\* $1 KL = $1.1
Lesotho became independent in 1966 and following this event, great emphasis was placed on national development, in particular, development of the road infrastructure.

At this time, ownership and control of all road construction plant and equipment was vested in the Roads Branch of the Ministry of Works. As early as 1969, it became apparent that if road development was to proceed at the hoped for pace, a more professional approach to management of the plant and construction equipment was needed. Specifically, there was a need to introduce an accounting system which would make adequate provision for the timely replacement of worn out life expired plant and equipment.

After careful consideration, the Government of Lesotho opted for a plant hire scheme, and a government Plant and Vehicle Poll System (PVPS) was established in 1972. The Pool assumed ownership of all mobile plant and vehicle formally held by Roads Branch, following which Roads Branch and other user departments were to obtain their plant requirements by hiring from the Plant Pool at rates fixed by the latter so as to make adequate provision for operating and maintenance costs and for purchase of replacement plant as and when necessary.

The establishment of the pool system created management and staff problems within the various organizations. Resistance to change and a differing view on priorities caused difficulties which resulted in a relatively poor service being given.

By 1983, the Lesotho PVPS was in serious difficulty compounded by low productivity, an oversized fleet, inadequately skilled artisans, and almost non-existent senior management. The result was very low availability and workshops full of broken-down equipment and vehicles, some of which had been broken-down for a considerable time (see Appendix 1). Technical assistance was provided under the World Bank Third Highway Project to strengthen the management of the PVPS.

A number of observations were made at this time, namely:
- productivity was low;
- the fleet had outgrown the service capacity of PVPS;
- there was an acute shortage of managerial and technical skills;
- the size, composition and condition of the fleet needed attention;
- customer relations were not good;
- there were deep-seeded accounting difficulties and organizational problems; and
- the proportion of staff time spent on training had slipped from 2.0% to 0.3%.

A series of policy decisions were made by the PVPS management and the Ministry of Works over the next year. These were:
- reduction in fleet size;
- reduction in spare holdings;
- the rehabilitation of vehicles and plant;
- regionalization of services;
- use of outside repair and servicing agencies;
- commercial hire;
- purchase of spares from main agents;
- review of hire changes; and
- increased training.

The effect of these decisions is seen in the following pages.

* This case study was prepared by the International Labour Organization (ILO).
Lesotho: Equipment Management - Case Study

Funding

To provide adequate funding, it was essential to set accurate and realistic hire rates. If the rates were wrong, the hire scheme would be unable to fulfill its functions whereas if they were too high, there would be vociferous calls from user departments for the hire scheme to be abolished.

The hire rates in use in 1983 had last been revised in 1989, and did not reflect true costs. New hire rates were introduced in April 1984, and revisions were made in 1985, 1987 and 1988. These regular revisions have kept the hire rates in line with costs and the Plant Pool fund balances are in a healthy state.

Repair of PVPS Plant by Private Repairers. This also works well, and a substantial proportion of PVPS plant repair is done this way. Recently, the work has been inhibited by attempts to insist on three competitive quotations before any job is contracted out. This is not practical with many plant repairs.

Repair of PVPS Vehicles by Private Repairers. All major accident work and a proportion of repair work is contracted out, an arrangement which also works well. No difficulty is experienced in getting competitive quotations for accident repairs, but there can sometimes be a problem with mechanical repairs.

Regionalization

The PVPS organization was very heavily centralized in Maseru. A degree of regionalization has been achieved, but there is still a long way to go. Regionalization cannot really be expected to function until there is a Regional Mechanical Engineer/Manager in each region with a strong executive powers and responsibility for everything that happens in his region. This brings us to the next heading.

Training

In 1983, there were no mechanical engineers on the staff of PVPS. There are now three with another six in training. It is hoped to be able to post Regional Mechanical Engineers to Northern and Southern Regions in the not too distant future. Progress has also been made with the recruitment of technicians into vacant supervisory posts after completion of courses at Lerotholi Polytechnic.

These measures have materially improved the situation of Plant Pool, and it can be confidently predicted that given a positive attitude the improvement will continue.

Finally, it should be appreciated by funding agencies who provide aid to developing countries that by their actions they may sometimes inadvertently contribute to the aid recipients’ problems. This is caused by insistence upon the supply of a particular type of machine, either because it is the lowest in price or because it is manufactured in the donor country, even when it is non-standard in the recipient country and when no spares or service support is available. On a more human level, great care should be taken in the
Lesotho: Equipment Management - Case Study

Selection of personnel to provide technical assistance. Technical expertise is, of course, a basic requirement but it must be understood that language difficulties or cultural differences, especially the latter, can and do create communication problems which may largely dissipate any amount of technical know how.

Appendix 1
<table>
<thead>
<tr>
<th>PLANT AND VEHICLE POOL SERVICE</th>
<th>1983</th>
<th>1989</th>
</tr>
</thead>
<tbody>
<tr>
<td>Workshops</td>
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</tr>
<tr>
<td>Bays</td>
<td>57</td>
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</tr>
<tr>
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</tr>
<tr>
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<tr>
<td>Mechanics</td>
<td>67</td>
<td>99</td>
</tr>
<tr>
<td>Spare Parts</td>
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<tr>
<td>Value</td>
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<td>m 452,000</td>
</tr>
<tr>
<td>Fleet</td>
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<td></td>
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<tr>
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<td>77%</td>
</tr>
<tr>
<td>Utilization</td>
<td>43%</td>
<td>71%</td>
</tr>
</tbody>
</table>
Topic B: Case Study

Madagascar: S.C.C.C. - Small Local Roadworks Consulting Firm*

The Project

The project started in 1985 with a broad objective of introducing labor-based methods into the Malagasy roadworks industry. Such methods had been abandoned in the 1950s when construction methods were mechanized. Mechanization was in response to the (at that time) very low population density, full employment, and the fact that mechanized methods suited the expatriate or French-trained local engineers. Roadworks were carried out by the Ministry of Public Works under force account or by international contractors. Labor-based methods were retained only in the form of lengthmen paid directly by MTP or the local authorities concerned. Consequently, no small roadworks contractors or small local consultants were required.

Major roadworks on bituminized roads are still carried out by international contractors and international consultants, but in many cases the consultancy role is a joint venture between a foreign and a local consultant. In the roadworks sector, there are four foreign consulting firms with a branch in Madagascar and four further foreign firms are in the country on a contract basis, in addition, there are some five foreign firms (multisectorial) that clearly could undertake roadworks and two major Malagasy firms of consulting engineers active in the roads sector. The two major Malagasy practices are both "transplants" one by privatization of a parastatal and the other by localization (in terms of personnel but not entirely of ownership), of a foreign consultancy.

The project constructs low-cost feeder roads by labor-based methods and the following became apparent:

- clearly in even the short term, the existence of only two local firms is undesirable from a competitive standpoint; and
- the promotion of small/medium-sized firms would greatly facilitate the design and control functions of future rural roads programs.

Organization

The Project HIMO (Haute Intensité de Main d’Oeuvre) has had funding from ODA, NORAD, the Dutch and Swiss Governments, and UNDP. So far it has completed about 300 km of feeder road rehabilitation, almost always with a gravel or stone wearing surface.

Up to and including the 1988 construction season, all specification, design and overall control has been done by the project team. However for 1989, the design and supervision role will be partly contracted out to local consultants. This follows a successful experiment in 1987 in which the firm S.C.C.C. and a similar sized "transplant" were contracted for the supervision role.

The supervision role for the works undertaken differs substantially from the same role when a major road contract is undertaken by a major contracting firm. Firstly, a considerable amount of detailed "adaptive" design must be carried out on site to fit the road into the intricate irrigation and other systems of smallholder (mostly rice) agriculture in mountainous terrain. Secondly, the level of contractor experience is often very low and in some cases so is technical knowledge; this requires the supervisor to offer suggestions and advise very much more than simply approving or refusing proposed modifications, inspecting quality, measuring and controlling the works.

The S.C.C.C. experiment did indicate that if consultants are to be used, they should at least contribute to the design phase even if only by way of detailed familiarization prior to the commencement of work. Where adequate experience exists, the full design commitment can, and in some cases, will be contracted out.

Promotion of Local Participation

Local participation by consultants has been confined to publicity and seminars. Many local firms of consultants exist although relatively few (see paragraph 1) are active in the roadworks sector. It is assumed that sufficient consultants in the buildings or irrigation sectors will add a roadworks capability to their repertoire of services to satisfy any immediate demand and that from so strong a potential base, new firms will be created to take advantage of any residual opportunities in the market. Promotion as such consists simply of making works available on a consistent basis.

The Company under Review

The S.C.C.C. consultancy has three principals, one non-executive director, one civil engineer, and one architect. The two executive directors trained and qualified in West Germany (Bauschule) and returned to Madagascar in 1980. S.C.C.C. was set up in 1984 and operated entirely in the buildings/structural sectors. The firm is retained by a substantial local building contractor as "tied" designer for design and building contracts. The firm currently employs two further civil engineers and two senior technicians trained in Madagascar. All three civil engineers and the two technicians have polyvalent capacity including both structures and roadworks, their experience is heavily weighted towards structures. Roadworks can however be undertaken to top up existing work load, and the firm would like to have a permanent and increasing commitment to this sort of work. The firm also employs eight ancillary workers (draughtsmen, secretaries, etc.).

Effectiveness

Clearly the experience under this project for S.C.C.C. in the roadworks sector amounts to little more than a sideline to an existing and solidly based consulting practice. The firm supervised the work on five simultaneous contracts in the Antsirabe area totaling 51.6 km. Construction was between September 1987 and March 1988 (all but one terminated early-January 1988). The supervision contract cost an inclusive US$8,700 which amounted to 5.6% of the net construction cost. Geotechnical testing assistance by the LNTPR (National Public Works and Buildings Laboratory) cost a further 2.5% on construction costs. All five sites were eventually completed to an acceptable standard and with a minimum supervisory/control input by MTP staff. S.C.C.C. management was satisfied with the experience and the Project HTMO judged the firm to have fulfilled its task satisfactorily.

Performance Comparison

The only available comparison of performance is with contract works supervised directly by MTP's own staff. Although qualified to similar levels of expertise, MTP staff are not used to supervising contractors at this level since the norms are either overall supervision (high level) of international contractor/major consultant combinations or direct labor works. Staff appropriate for supervising small-scale works are much better at doing the work than supervising and counselling contractors. It must also be admitted that the somewhat flexible standards applied to MTP's own force account works (due to fixed, hastily prepared and often under-funded budgets) can carry forward into attitudes towards work standards in general; whereas under an agreed contract that is fully funded no such compromises are necessary. In bringing a professional consultant's attitudes to bear S.C.C.C. did a good job at a price that is reasonable as an on-cost to construction expenditure. The cost of this service is estimated at being only 40% higher than the similarly inclusive cost of the same work carried out by MTP. However, the estimate takes no account of any differences in quality level or the indirect benefit of reducing work load and administrative cost within the Project HTMO.

Contract Format

The contract format was very simple and set out the contract conditions; the services to be provided and standard forms to be filled in by tenderers to build up price and indicate the capacity and intentions of the tenderer. Personnel prices were based on man-months per specified type of personnel while transport and office costs were on a fixed price monthly rate. Perhaps rather curiously, but normal in Madagascar, the cost of monthly inspections by client and MTP staff was also included as a reimbursable item (receipts + 5%). Payments were by net monthly account from commencement of the works.

Further Promotion

As indicated in paragraph 3, it does not seem likely that the solidly established consulting industry in Madagascar will need any significant encouragement to expand into and fill any opportunities that may arise in the road design and supervision sector. Existing firms plus new firms created by spin off from these should be able to train up new staff at a rate commensurate with any envisageable growth rate.
Topic B: Case Study
Madagascar: Ets. Razakamandimby - Small Local Roadworks Contractor*

The Project

At the end of 1986, the Government of Madagascar launched a program to promote the formation of small/medium-sized companies with a view to their participation in the industrial sector (artisanal or import substitution activities) and the construction sector (materials, buildings and roadworks). The Ministry of Public Works (MTP) has since been active in necessary promotion for the construction sector but with relatively little need to intervene in materials production which is mostly industrial and not, therefore, public works or the building industry which is already largely dominated by local companies for both design consultancy and construction itself. Roadwork has traditionally been completely dominated by international contractors and consultants for new works and force account operations by MTP for maintenance work of all kinds. Since setting up a roadworks contracting company would normally require a very substantial initial investment in plant and implies that work be let in substantial sized contracts, it was decided that initial programs (at least) be labor-based in method and divided into construction contracts of 6 to 12 kilometers in length, thus limiting initial investment as far as could practically be arranged.

The whole promotion campaign has been backed by training programs: for small contractors to undertake independent contracts (financed by ODA and NORAD), and for small contractors to undertake subcontract works (financed by the Swiss Government).

The works themselves have been financed by a variety of funding agencies:

- for rehabilitation works: the Dutch Government, NORAD, UNDP, the Government of Madagascar, WFP, and several local provincial authorities;
- for routine maintenance work: the Government of Madagascar and the provincial authorities.

The 1988 and 1989 maintenance programmes cover some 5,000 km of roads of which about 4,000 km is tarmacadam surfaced (although some 1,500 km of this is in fairly poor condition).

The Dutch Government financed the rehabilitation of 94 km of secondary roads in 1987 and has a program for 89 km in 1989. NORAD financed rehabilitation of 42 km in 1988 and has a program for 68 km in 1989. Within the MTP's labor-based "umbrella" project (Project HIMO—Haute Intensité de Main d’Oeuvre), the government and local authorities (in some cases with WFP funds derived from rice sales) have financed about 150 km to end-1988. The UNDP financed 36 km in 1986. Both EDF (101 Km scheduled so far for 1989) and IBRD with the PASAGE project (about 800 km for 1989-90) are now participating in the overall program. All the roads are secondary by character and generally in very poor condition requiring comprehensive rehabilitation/reconstruction but relatively few major earthworks or large structures (over 6 meter span).

As a general rule, the routine maintenance works at end 1988 prices cost US$140 to US$270/km, and rehabilitation works cost US$3400 to US$8000/km so that although the combined construction budget to date is a modest US$2 million, it has taken time to mobilize funds, train contractor’s staff, and is constrained to only committing funds to suitable contractors with adequate resources (all types) to execute the works.

The training program has so far involved 298 technicians of which 254 were sent by 200 small contractors in Antananarivo, Fianarantsoa, Mahajanga and Toliary Provinces. MTP technicians trained include two training officers from each of the six provinces of Madagascar.

* Prepared by Mr. Lindsay Thomas, of Scott Wilson Kirkpatrick & Partners, Roads Adviser to the Government of Madagascar.
Organization

To a large extent funding has been made available to MTP by the various funding agencies outside of an integrated project. While often tied to particular roads, the Project HTMO has been responsible for planning, specifying, designing and the general control of the works. Some works in each year have been done by force account so that MTP has a precise idea of costs, and some supervision of site works has been contracted to local consulting firms. The great majority of works has been contracted out to recently formed small roadworks contractors. The project team currently comprises four Malagasy engineers, two expatriate specialists in labor-based works, ten technicians, and some 15 supporting staff.

Promotion of Local Participation

Local participation has been promoted almost entirely by positive means such as training; choosing technology suitable for low budget start up; a mix of rehabilitation, subcontract and routine maintenance work; ensuring that local commercial banks have available loan funds; making contract analysis available to bankers if so required; hiring out available MTP equipment to some participating contractors; and seminars aimed at clarifying set up procedures/advantages/difficulties/discussion.

No price advantage has been necessary since such small scale works are of no interest to major contractors and moreover labor-based methods cost between one-third and one-half of equivalent machine-based methods for which major contractors are set up.

The only artificial advantages that may be considered as existing to a limited extent are low hire rates on agricultural machinery in the dry season and the ability of MTP to provoke a favorable response from local bankers. All charge rates are, however, based on commercial reality in Madagascar. In addition, a very few local contractors who have been formally "approved" benefit from a favorable tax treatment in the first four years after approval, a promotional device common to very many developed countries.

The Company under Review

For the sake of clarity, this study refers only to a single company which can be regarded as fairly typical of the 14 firms that have so far done road rehabilitation works. Ets RAZAKAMANDIMBY is a family-owned firm set up in early 1987 in response to MTP Publicity aimed at promoting the formation of such firms. The principal of the firm (after whom the firm is named) had been until end-1986 employed for 16 years as a senior geotechnician by LNTPB, the National Public Works and Buildings Laboratory. His wife, who is a university-trained (Madagascar) engineer, remains employed outside the firm. To assist with site works, he employs two young technicians with diplomas from the Antananarivo Technical College and six skilled workers to act as group leaders. However, all employees are subject to periodic lay-off when no work is in progress. Between September and December 1987, the firm rehabilitated 6.7 km of a difficult road from Fandriana to Tsarazaza (Dutch Government funds) for US$22,000; from March to May 1988 subcontract works on the Madraka descent, National Road 2 (Swiss Government funds) for US$8,000, and July 1988 to January 1989 completed 10.6 km from Faratsiho to Antsampa-nimahazo (NORAD funds) for US$62,000. Starting with just one pick-up (Peugeot 404), the firm has since acquired two Mercedes ten-ton tipper trucks and a one-ton vibrating roller. Plant purchases are all second-hand, but functional with effort.

Effectiveness

With no initial problem to raise outside financing, the firm has carried out works promptly and within agreed time delays. The quality produced is eventually acceptable but only becomes so after control pressure is brought to bear. All work has been obtained as a result of open tender at normal prices for the type of work involved. Plant purchases suggest and the proprietor confirms in imprecise terms that operations so far have been profitable. The proprietor stated that the investment and risk had been worthwhile. One unusual aspect of the NORAD-funded work recently completed was that the contractor was obliged by the contract to employ 25% female labor. Since this company had decided of its own accord to employ female labor on the Fandriana-Tsarazaza site, the project staff had anticipated no problems with this requirement. However, several strikes occurred, and direct intervention by project staff was needed to resolve differences that arose. This has given rise to the conclusion that control of site works must also include controls designed to protect ordinary laborers from possible unfair exploitation that might arise.

Performance Comparison

The quality standards achieved by Ets RAZAKAMANDIMBY are average by Project MO norms. As is generally the case with roads built by labor based methods the long section is slightly inferior (undulations of several metres wavelength) to roads produced by mechanized methods, but the cross section and drainage works are as good and in some cases better. Since vehicle speed is not a major criterion on the very winding mountain roads of Madagascar an undulating long section is not considered a major drawback. Many
other factors mitigate in favor of labor-based methods in this gravel scarce country, such as ability to exploit very small or thin deposits and to use techniques such as waterbound or surface stone macadam and even cobblestones.

The small contractors clearly have to make a profit, pay turnover tax (15%) and company tax, but in general can complete works to similar standards and at the same cost as MTP can achieve by force account. Naturally MTP is to some extent constrained by bureaucratic procedures and delays which appear to equal in cost terms, the commercial and fiscal constraints on contractors. Major (international) contractors using mechanized methods generally charge about 2-1/2 times as much as a small local company for rehabilitation of secondary (not bituminized) roads.

Between a call for tenders and contract award, a time lapse of only six weeks has been achieved due to the small scale of the contract and the simple form of contract documentation.

**Contract Format**

The contract comprises: standard conditions into which the identity of the job, its timing and any special conditions can be inserted; a standard materials specification of norms to be achieved during construction; a bill of quantities that comprises 20-30 inclusive items subject to remeasurement; a description of the works that concentrates on those principal items and indicates, when minor exceptions occur, with which item the exception is to be included as a spot price; and standard forms to be filled in by tenderers to build up price and indicate the capacity and intentions of the tendered.

Due to a poor history of what can occur if advance payments are made, NO advance payment is allowed but certificates can be requested on a monthly basis provided certain minimum amounts are ready for measurement; generally this is 1 kilometer completed. Upon certification, interim payments are usually made within two weeks and final payment within six weeks. A 12-month maintenance period on 2% retention is usual.

A considerable amount of detailed design is done on site by agreement between the contractor and the supervising engineer. This is to enable the contractor to propose materials that are actually available and in relevant cases methods of carrying out the work to suit such materials and/or resource constraints and/or unforeseen conditions.

**Further Promotion**

Most of the conditions for promoting continued growth in this type of work are already catered for: training, bank financing, fiscal treatment, limited plant hire facilities and advisory services. The main constraint is financing to improve plant availability, create a steady work load during the year and indeed a coherent program from year to year.

The long-term plan anticipates that small contractors will either grow or merge into medium-sized contractors, and that the most capable and successful firms will eventually become large companies able to mechanize their operations and compete successfully for major contracts by international tender.
Introduction

Faced with necessary reconstruction after the 30-month old civil war, which ended in 1970, and the challenges of developing the Nigerian economy, the ruling military administrators found solace in the world energy crisis of the 1970s and the attendant booming of the oil dependent economy. Development policies were concentrated on mass education, construction of road infrastructures and the nursing of newly acquired capital intensive industries. Urbanization grew due to better wages and employment prospects in the cities. This led to the neglect of rural agriculture and food production. There was also a rapid growth in population from the initial rate of 2.5% in the 1960s to 3.3% in the 1980s. The nation’s current population of 112 million is heading towards 200 million in early 21st century. By the year 2030, Nigeria will be the fourth most populated country in the world!

Since the steep decline of oil price in 1981, the Nigerian economy has been on the decline. There has been capital flight to foreign countries. This is reflected in the country’s external reserve dwindling from a height of US$9.8 billion in 1980 to its current US$1 billion mark. Also, the standard of living of Nigerians has fallen closely in line with the decline in per capita income from US$1000 in 1980 to its present US$370. Subsequently, the country has been regraded by the World Bank, from its former middle-income group, to one of the world’s poor countries.

In an attempt to revive the economy, the government introduced a Structural Adjustment Program (SAP) in 1986. This program aims at removing the constraints to free enterprise with government’s reliance on private initiative while providing the necessary infrastructure, incentives and maintaining the general macroeconomic framework. This approach to the economy is internationally considered to be appropriate. (1)

The main feature of SAP is the marketization of the country’s monetary system, which the government considers the best route to finding the true value for the overvalued currency—the Naira. Its initiation fulfills one of the conditionalities of the International Monetary Fund (IMF) and the World Bank for financial assistance. As a result of this policy, the purchasing power of the Naira in international market has fallen quite drastically (see Table 1). Consequently, local industrialists (including construction contractors and consultants) are faced with the urgent need to seek alternative local sources to expensive raw materials, labor and equipment. The citizens’ taste for foreign goods is gradually changing. Also at the federal and state government levels, attitudes are changing to maintaining existing infrastructures rather than the former replacement approach. This was described in the 1989 budget as the rise of the ‘maintenance culture’ instead of the ‘replacement syndrome’ of the profligate past. The federal government has also reduced subsidies on petrol thereby making a saving of N488 million which has been diverted to a Special Projects Fund to finance projects such as the maintenance of roads and railways.

With these realistic changes in budgetary policies, the country has attracted favorable international commendations. It has also been able to reschedule its enormous US$26 billion debt and the way now seems to be clear for a considerably greater coordinated inflow of foreign assistance (2). The author believes that Nigeria epitomizes a Sub-Saharan African country needing ideas on policies regarding road maintenance at this critical time in its development. Hence it’s choice for this case study.
Current Road Maintenance Practice in Nigeria

The first reaction of government parastatals to the shift in emphasis to maintenance was the reinforcement of existing in-house maintenance sections in States' Ministries of Works and the Federal Directorate of Roads. These in-house maintenance departments—otherwise called Direct Labor Organizations (DLO)—employ operatives on fixed monthly wages and with equipment/ plant acquired over the years, maintain roads within their areas of jurisdiction. Road patching forms the major bulk of maintenance work carried out by these DLOs.

Table 1 - RATES OF EXCHANGE FOR THE NIGERIAN NAIRA, 1981-1988

<table>
<thead>
<tr>
<th>End-Period</th>
<th>Market Rate/</th>
<th>Nominal Effective Rate/b</th>
<th>Real Effective Rate b/</th>
</tr>
</thead>
<tbody>
<tr>
<td>1981</td>
<td>1.5701</td>
<td>103.4</td>
<td>110.8</td>
</tr>
<tr>
<td>1982</td>
<td>1.4920</td>
<td>108.2</td>
<td>113.7</td>
</tr>
<tr>
<td>1983</td>
<td>1.3359</td>
<td>112.3</td>
<td>134.3</td>
</tr>
<tr>
<td>1984</td>
<td>1.2372</td>
<td>120.4</td>
<td>185.0</td>
</tr>
<tr>
<td>1985</td>
<td>1.0040</td>
<td>110.4</td>
<td>166.0</td>
</tr>
<tr>
<td>1986</td>
<td>0.3015</td>
<td>61.6</td>
<td>90.9</td>
</tr>
<tr>
<td>1987</td>
<td>0.2415</td>
<td>16.6</td>
<td>26.5</td>
</tr>
<tr>
<td>Mar 1988</td>
<td>0.3015</td>
<td>15.7</td>
<td>n.a</td>
</tr>
<tr>
<td>Jun 1988</td>
<td>0.2318</td>
<td>15.4</td>
<td>n.a</td>
</tr>
<tr>
<td>Sep 1988</td>
<td>0.2136</td>
<td>17.4</td>
<td>n.a</td>
</tr>
</tbody>
</table>

/a/ US dollars per naira
/b/ 1980 = 100


However, inefficiency and lack of enterprise, which is common in most government parastatals in the country, prevail in these DLOs. Construction plant and equipment are not well maintained due to stringent bureaucratic controls, shortages of spare parts or absence of necessary expertise in government ministries to maintain them. Even when the DLOs eventually maintain roads, the jobs are done in the rainy season when the road deterioration problems are worst felt by the citizens but when no patching would stick! It is doubtful if government departments can cope with road maintenance since they are not geared to sound financial management which is necessary in the construction business environment.

Since government departments do not have the necessary facilities for large maintenance works (e.g., asphalt plants, quarries, etc.), such projects are often contracted out to contractors. These may include road resurfacing or new overlays to township roads at State or Local Government level. Although the regional offices of the Federal Roads Department can undertake larger maintenance projects they also contract badly deteriorated roads (e.g., Benin-Lagos express road), to private contractors for maintenance. All major roads (trunk A) linking the 21 states of the country are the responsibilities of the federal government, while those linking towns (trunk B) are managed by the states and those within towns and in and between villages are the
responsibilities of the local councils. There is, however, some overlapping of these responsibilities. As roads are contracted out for maintenance, they are supervised by officials from the Ministries or Directorates. Small maintenance contracts often lack any detailed form of contract.

For example, on recent road maintenance contracts awarded by the directorate of rural roads in one of the states, the directorate issued invitations to contractors to "regrade and resurface local roads with gravel" at N12000. No other details (e.g., bridges, levels) were given. Well established and reputable local contractors failed to apply for these contracts as such vague terms of contract would lead to losses. The government consequently persuaded them to take up at least 10 km length of road at that price. However, on larger (states and federal) road maintenance contracts, there are detailed designs and specifications with a legally binding form of contract. The forms of contract vary from one contract to the other but largely reflect the British standard forms (see Okpala and Aniewu (5)).

Although there used to be some payment difficulties between 1983 and 1986 resulting in the abandonment of many road maintenance contracts, the situation has now improved with the government paying contractors regularly—one of the advantages of the earlier mention SAP.

The approach of a typical Nigerian contractor who has undertaken some road maintenance projects for both state and federal governments in the recent past and has outlived the economic turbulence in general road maintenance and construction by skillful organizational structure and awareness of Nigeria’s economic and political cultures is now examined. The name of the firm is withheld for confidentiality purposes and would simply be referred to as AZ Nigeria Limited.

The Contractor

AZ Nigeria Limited is an indigenous civil engineering company established in 1976 during the oil boom era. Its establishment was encouraged by the Government’s initiative to increase indigenous participation in medium to large sized construction projects. Under this program, the Government devised the ‘mobilization fee’ clause whereby 10% of the contract sum was given to indigenous contractors to cover initial overhead expenses of setting up large construction sites. This was necessary because foreign contractors, with their large capital base, out performed the local contractors in large-sized contracts. While most Nigerian construction companies abused this privilege by absconding and going into voluntary liquidation, AZ was faithful and has prospered in contracting business. Current turnover exceeds N300 million in 17 states and a fleet of over 250 construction plants and equipment.

The company has built up the personnel and expertise required for the broad spectrum of civil engineering projects undertaken by the company by employing foreign professionals who have taught their indigenous deputies, across projects, the art of profitable construction management. Because of the devaluation of the Naira and the consequent reduction in the value of their home remittances, these foreign professionals have started leaving the country with Nigerians being promoted, becoming more motivated (see Olomolaiye and Ogunlana (3)), and new employment being generated.

Although AZ does not have any new road maintenance contracts at the moment, they are bound by the terms of a former contract, the "maintenance period" clause, to maintain township roads valued above N10 million. Although the maintenance period is only one year on two other road maintenance contracts, AZ has continued maintaining these other roads for the past three years because they are still in the area. It is the company’s policy to maintain beyond the "maintenance period" while still in an area as long as the costs are reasonable. The company adopted this policy to maintain good reputation and avoid any possibilities of political intimidation. Maintenance during the mandatory period is done through a system of monthly checking of these roads, reporting to the head office and then carrying out the necessary maintenance after costing.

In the township road maintenance contract which was to overlay with asphalt, the personnel consisted of a site agent, a site supervisor, one foreman, one mechanic, three operators and rakers whose number depended on the length of road to be done on a particular day. The equipment involved were two steel drum rollers, one tyre roller, two jerk hammers, two pavers (one as stand by) and some shovels. In addition to these the company owns several other equipment. Considering the high cost of equipment repairs the company was asked a pointed question on equipment maintenance.
AZ has a central plant workshop with a general plant manager who monitors equipment utilization and maintenance. On the township road maintenance project, the equipment averaged 80% productive time which is high considering Lashabi’s report on plant utilization in Nigeria (4). The central workshop is fully manned by Nigerians, trained under the expatriates, who have acquired the expertise to make and modify spare parts or even the whole plant. Parts which cannot be made, modified or purchased locally are ordered from overseas. But for unexpected repairs, all major repairs and plant overhauling are done during the rainy season when road maintenance cannot be effective.

AZ Nigeria Limited currently has its own asphalt plants and 12 quarries within its catchment. This gives it distinct advantages over the government DLOs or any new contractor in AZ’s catchment, who normally ask the company to supply aggregates and asphalt. These quarries and asphalt plants helped to ensure AZ’s economic survival over the past 12 years. While AZ pays the Nigerian Mining Corporation for quarrying license, it also fulfills its social obligations to local communities around the quarries. For example, the company has just built a hall for one of such communities. While foreign contractors are sometimes forced to bear such social responsibilities to the communities because they believe that their mining license suffices, indigenous companies do not find it difficult to understand, and company chairmen may even be rewarded with an honorary title. The social costs are incomparable to the apparent cost advantage of such quarries in reducing overheads and making the company’s tender for road maintenance more competitive than other contractors. This advantage was demonstrated in the township road maintenance project where the contractor was able to undercut the nearest bidder by a wide margin and still make a handsome profit.

Possible Road Maintenance Strategies in Nigeria

AZ Nigeria Limited epitomizes some of the advantages postulated in the main policy paper of local contractors undertaking road maintenance projects. The company already has established offices and a trained indigenous workforce, the effectiveness and loyalty of which the DLOs cannot match. While foreign contractors tried in the ‘boom’ years to buy such indigenous expertise and loyalty with attractive reward packages, the sociocultural identity which is the basis of employee loyalty within the Nigerian cultural setting, eluded these foreigners. With recent economic hardships, many foreign contractors did not find it difficult to sack their employees and join the capital flight train, i.e., selling their equipment and moving on to ‘greener pastures’.

Due to the urgent need to maintain some major roads, the government contracted out to some foreign contractors still in the country. These contracts are paid for in oil (under counter trade agreements) while those done by indigenous contractors are paid in Naira. Oil fetches hard currency while the Naira depreciates daily. While indigenous contractors are struggling to survive and be innovative with the resultant development of the nation’s technological competence, foreign contractors simply buy parts from their home countries. This unfair mode of payment in the construction market place needs to be removed for both foreign and local contractors to compete fairly. If the current economic state persists, the author believes that foreign contractors would either leave or stay to contribute to construction and maintenance development in Nigeria.

A Business Reorientation Program for Established Contractors

As mentioned earlier, the ‘mobilization fee’ clause was introduced to encourage local contractors to form large construction businesses. While this policy helped AZ to acquire equipment and be established today, it was doomed by not recognizing that most of the civil engineering companies set up in the 1970s were not setup by ‘career construction professionals’. This omission accounted for 90% of these firms winding up after collecting the mobilization fee which many, unfortunately, saw as their legitimate share of the oil boom. Any attempt at motivating the local contractors should recognize the professional background of new contractors. In fact, any motivation package should focus on established local contractors. These established contractors should be part of a government retraining program which should have its main focus as “Contractor Reorientation”. The main features of this reorientation program should be:

- retraining them to respond to economic and political indicators.
- selling some of their heavy equipment as additional revenue to maintain just a few needed
for road maintenance projects, i.e., an equipment optimization scheme. The AZ equipment conversion initiative may be the model.

- training support by the government or any international agency to established companies.

Construction Personnel Training Program

Although AZ projects a picture of personnel adequacy, this would be an erroneous picture of construction personnel adequacy in Nigeria. The Nigerian construction industry lacks adequately skilled craftsmen, mainly due to the education system which laid much emphasis on paper qualification rather than the practical training needed in the construction industry. The available skilled craftsmen were trained on-the-job by different contractors and the few trade schools. Unfortunately, those from the trade schools often feel degraded if asked to work as a tradesmen as they prefer to be ‘head men’. Those trained by contractors often have narrow specialization which makes it rather difficult for them to change jobs. There is an urgent need for a national training program for construction personnel to relieve the local contractors from the burden of employing unskilled hands and to standardize construction skill acquisition by tradesmen. As the trade school approach has failed to produce ‘real’ craftsmen, the author would suggest a more practical approach inform of a Nigerian Construction Industry Training Center where local contractors can send their recruits for skill acquisition at subsidized cost. Apart from a standardized training program, such an institution should also be involved in manpower forecasting and monitoring for the industry. It can also be charged with arranging continuing education programs for senior construction personnel. This is an area of technical assistance which an agency like the ILO or any foreign aid agency could concentrate to help the local contractors.

Long-Term Maintenance Contracts

A foreign contractor wanting to have a foothold in road construction in Western Nigeria in 1964 offered a ten-year maintenance guarantee on a 40-mile stretch of dual carriageway road between Ijebu Ode and Ibadan, in addition to other contract clauses. The then Western Regional Government awarded the contract to this contractor. The road is on record as one of the best constructed and maintained roads in Nigeria today. With such a guarantee, a contractor has to do a better job as he will only incur more maintenance cost if he does not. However, the ‘maintenance period’ clause in today’s contracts is just for one year when no serious structural defects would have surfaced.

Long-term maintenance period clauses would help tie the contractor down to the road he has constructed or newly maintained. This, undoubtedly, would lead to higher contract sums for newly constructed and maintained roads. It should, however, be remembered that the ‘cost in use’ concept is best demonstrated in roads. The problem would then be how to tie down the contractor to maintain roads which are not properly managed. In Nigeria, heavy vehicles always disobey laws regarding axleload weighbridge with impunity. This leads to faster deterioration of the roads than normally envisaged in any maintenance contract. In the authors opinion, the inefficient DLOs should be scrapped and replaced with profit/efficiency conscious companies charged with road management which would include toll collection, enforcement of weighbridge rules and reporting necessary repairs to maintenance contractors who should be on cost plus fixed fee contracts. The vast equipment assets of DLOs could be sold to profit-oriented plant hiring firms which would render good service to the contractors when they need equipment. Such plant hiring firms are already springing up in the southern part of the country.

Again, how do we have a long-term maintenance contract for a badly designed road? Road designs are normally done by the government ministries. Due to lack of practical experience, the road designs are often of inferior quality and offer less value for money than the alternatives which contractors have learned to submit with their tenders. By submitting alternative road designs, contractors have acquired better expertise in road design than even private consulting engineers whose qualitative but expensive solutions are often rejected by the government. Also, most of these designs by consulting firms follow international standards which do not recognize peculiar Nigerian geology, climate, and economy. While budgetary constraints have been the normal excuse for poor quality road designs, road designers can cut cost by reducing international road signs and markings standards. Maintenance cost can be reduced by concentrating on the main structure of the carriageway not on signs, road markings and grass cutting.
**Conclusion**

AZ Nigeria Limited has thrived in the harsh business climate of the Nigerian construction industry by its effectiveness and responsive managerial drive for success. Many other local contractors can successfully manage road maintenance if the enterprise culture in them is allowed to thrive. The support needed should be in the form of business orientation courses and a skill monitoring and development center in the form of a Nigerian Construction Industry Training Center. This should be complemented with the reorganization of government direct labor organizations into two forms of companies—road management companies and plant hiring companies.

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**References**

Institutional and human resources development in road maintenance are affected by a significant number of socio-economic factors that originate inside and outside road agencies and have a decisive impact on road maintenance efficiency and effectiveness. Government officials and sector managers need to address these factors and reform road maintenance institutions and the management of human resources. Commitment to institutional reform and human resources development is critical to the successful implementation of policy reforms.

Institutional and human resources performance and development in road maintenance can be addressed by a variety of measures. It is important that policy makers and top managers keep in mind that road maintenance institutions and their manpower are the basic resources for implementing the country’s road maintenance program. The workforce is usually the largest expenditure item in a road agency’s budget. Both institutions and human resources must be actively managed and in effective ways. A good starting point for approaching these issues is to conduct an institutional appraisal to assess institutional and manpower strengths and weaknesses.

The two main issues that need to be addressed are:

- institutional reform to increase institutional accountability, strengthening overall institutional efficiency and effectiveness and providing incentives.
- human resources development to increase staff accountability, motivation and competence, strengthen overall manpower performance, and build a core staff of competent professionals.

Changes in each of these areas will affect the other, as the performance of institutions cannot be divorced from the performance of the manpower within them.

Institutional Reform

Problems

After three decades of investment in institutional and human resources development, Sub-Saharan African road maintenance institutions are not performing efficiently and effectively and still need large amounts of technical assistance. It has become apparent that effective institutional performance is not so much a question of amassing adequate financial, human and technical resources, but of using those resources more efficiently and effectively.

The major institutional constraints facing most Sub-Saharan roads agencies are a lack of accountability and autonomy and a lack of separation of the planning and implementation functions.

Policy Options and Actions

To strengthen institutional accountability it can be helpful to assess the institutional performance of the road agency and its overall service delivery setup. Such assessments should examine existing arrangements and their effectiveness. Issues to be considered would include such things as the use of force account and private contractors, the allocation of responsibilities nationally and locally, the agency’s technical and implementation capabilities, and coordination between government entities to develop and implement comprehensive and appropriate road maintenance policies. Such an assessment can be followed up by an appropriate set of measures to address the specific problems identified.

Establishing a system to monitor road agency performance and physical results can also increase accountability. A basic starting point for improving the performance of any institution is to measure and monitor its performance in terms of outputs and physical results. This is a practical basis for setting standards and making improvements. For road agencies this means establishing monitoring systems (management information systems) to keep track of road network conditions, what physical improvements are being achieved over given periods of time, and the type of work backlog that remains. Such monitoring creates the foundation for increased accountability and for an increased specificity regarding what is to be done.

Delivering parts of the road maintenance program through private contractors might also be considered. Lack of incentives to perform is one reason why there are problems with the provision of road maintenance through force account. Contractors have built-in incentives to perform well so they will be paid and receive more work. Force account does not have these incentives and the quality of its performance has few
practical consequences in terms of rewards or sanctions. Additionally, road agencies operating by force account are hampered by having to contend with major constraints like civil service regulations, procurement regulations, bureaucratic impediments, overstaffing, and lack of funds.

An institutional environment must be created that will increase the accountability of road agencies both to road users and to the government agencies that supervise them. Publics and road users must be better organized into associations that expect a certain level of service and can bring pressures to bear. The government must also monitor and expect results.

Giving a road agency more freedom to act—and more responsibility for its actions—by making it semi-autonomous can also increase institutional performance by freeing the agency of many of the constraints inherent in the public sector. Agreements between ministries of public works and roads departments that spell out what is to be achieved and by what means can be the basis for such arrangements. A semi-autonomous highway agency operating with a road fund outside the main constraints of the civil service has additional opportunities to improve institutional performance. Increased autonomy makes it easier for the agency to manage its human resources, financing and procurement independently and more effectively.

Separation of the planning, works execution and audit functions, coupled with a strengthening of the planning function, can greatly improve institutional performance, accountability and specificity are increased when functional responsibilities are separated. Also, improved planning more clearly defines and specifies what is to be achieved, how, and by whom and when.

African Experiences

Performance monitoring, management information systems, and increased accountability and competition in Malawi: The maintenance and rehabilitation management system (MARMS) was adopted in 1984 to improve management of the road maintenance program of Malawi's main road network system.

MARMS provides the basis for achieving uniform road maintenance levels throughout the country, preparing an annual work program based on priorities identified from maintenance feature and/or condition inventories, and an acceptable level of service as determined by policy makers. It is also used to allocate resources, i.e., labor, materials, and equipment, prepare a performance-based budget to support the annual work program and schedule and authorize work. It includes a framework for reporting work performance to permit management to control and evaluate the maintenance work program and operations.

MARMS has assisted management in identifying in detail the maintenance workload for each management unit and breaking it down to activity level. This has made it possible to set and measure performance for the road maintenance effort as a whole, and also to evaluate the effectiveness of the road maintenance efforts of each management unit. Through the reorganization of road maintenance districts and zones, it became easier to identify requirements for road maintenance supervisory personnel, base camps, and equipment. It also became easier to identify training needs for staff development to increase technical and managerial skills.

Along with the introduction of MARMS, the roads department was reorganized to provide a structure with additional senior technical staff to take responsibility for planning, control and evaluation of maintenance rehabilitation. The main changes were:

- the formation of a maintenance and construction division at headquarters level.
- the formation of a separate road planning division.
- the establishment of a mechanical section to take responsibility for the provision and implementation of a preventive maintenance program for the department's basic equipment fleet.
- the establishment of a monitoring unit within each operational division of the roads department.

Institutional and position "twinning" in Ghana: Twinning links an operating entity in a developing country and a similar organization in another part of the world. A twinning arrangement has been tried out relatively successfully between Staffordshire County Council in the United Kingdom and the Accra City Council in Ghana. The advantages have been as follows:

- the institutional link between like institutions has enabled the inter-relationship between political, managerial, administrative and technical problems to be fully examined. The political and institutional implications of an apparently simple technical decision such as establishing specific links between direct service delivery and revenue collection are more apparent to an institution that faces similar problems.
- by explaining the Staffordshire institutions to Accra City Council staff, Accra staff have been able to draw conclusions that may be relevant to Accra
while not immediately apparent to Staffordshire staff.

- once trust has been built up between individuals within the institutions it is possible to examine not only successful schemes and systems, but also to identify practices to be avoided and systems that are no longer applicable.

### Human Resources Development

#### Problems

Though there is still a shortage of accountants and competent managers in many Sub-Saharan Africa roads agencies, the education and training systems have produced many good highway engineers, and technicians. Notwithstanding, institutional performance has not improved significantly. This is because these personnel have not been effectively utilized, developed and retained. Initially the focus was rightly on training. Now it is becoming more apparent that the human resource problem is not only one of education and training but one of utilization, motivation, development, and retention.

There are a variety of factors which may cause ineffective manpower utilization, development and retention, including the authority, rules and regulations of the civil service and resulting personnel policies; conditions of employment and pay within public sector agencies; the lack of overall external institutional accountability and internal staff accountability; and the level of the road agency's organizational efficiency, structural complexity and general ability to attract, retain, train and motivate technical and managerial staff.

These manpower utilization and development constraints can result in serious problems: lack of staff accountability; difficulties in retaining competent staff; loss of good staff to the private sector; lack of on-the-job development and motivation; lack of application of previously learned skills, stagnation and waste of expensive education and training; and generally low levels of manpower productivity.

#### Policy Options and Actions

The build-up of a competent core of managerial and technical manpower that can perform effectively in support of institutional objectives is essential. There are two main approaches to this:

- create a Personnel Unit within the road organization to strengthen its capability for manpower planning, recruitment, training needs analysis, organization of training, management of promotion and career development schemes, and administration of compensation and benefits; and,

- strengthen the ability of line managers to utilize, supervise, motivate and develop their staff effectively.

To carry out these goals, the personnel unit and line management will require development of special skills and the installation of supporting administrative systems. Line management in particular will need to acquire management skills such as how to set objectives, allocate work, delegate and follow up, set standards, establish accountability, and provide subordinates needed on-the-job training, recognition, and feedback. The two sets of responsibilities (personnel and line management) should be integrated into a single long-term manpower development and retention program. To effectively implement such a program, roads agencies should introduce changes in hiring, promotion and termination practices to strengthen motivation, retention of talent, accountability, and performance.

When free to operate semi-autonomously (but not only in such cases) the road agency can hire only those people that it actually requires to do its job. It will not become financially overburdened with staff on the payroll that it does not really need. Cuts of unnecessary staff can free money for operations, supplies and equipment and can improve effectiveness and efficiency in the use of remaining staff. This enhances the motivation and retention of competent people. Staff can be better managed and utilized because funds become available to secure the equipment and supplies necessary for them to do their jobs. Since staff obtain the means to carry out their responsibilities, they also tends to become more motivated. The agency's semi-autonomy from the civil service can also allow management to promote staff on the basis of merit and accomplishments rather than just seniority. A staff that does not perform can also be more easily removed from the payroll. This kind of management of human resources in terms of hiring and firing and career advancement is a very important tool for increasing the internal accountability and motivation of an organization.

Another way to improve staff performance is through an organization's compensation and benefits system. A semi-autonomous agency has more flexibility to pay people at the level required to retain the kind of talent it needs, in competition with the private sector. Even without autonomy, a road agency can still institute innovative compensation schemes such as pay directly linked to quantities and quality of outputs and results.
produced. The compensation system is an important tool for strengthening manpower management.

Effective manpower utilization also requires a good system of position descriptions, management by objectives, appropriate work load allocations, and effective staff supervision. These are basic personnel and work management tools. Good utilization of manpower requires appropriate work load and responsibility allocations within units and within the organization. Within a unit, it is the unit line manager’s responsibility; within the organization, any need for overall organizational restructuring should be identified and addressed by general management.

It is also important for an agency to identify training needs, and develop and deliver the required courses in essential and specific, job-related skills. For training and other developmental actions to be effective, they need to take place in a context of improved manpower management and utilization. It is important to remember that if manpower management and utilization are not operative, people that are sent on training might soon be lost to the private sector. If they stay, they may tend to stagnate and not develop in ways that are practical and useful for the organization.

When strong manpower management and utilization are in place, in-service training schemes make an indispensable contribution to staff development. In addition to the educational qualifications and experience that staff bring to the job, they need to develop additional job-related specific skills and specializations. Careful training needs analyses should be conducted to determine precisely what knowledge and skills are needed by each category of staff. Arrangements should be made for the development and delivery of suitable, applied, in-service courses targeted to the most essential technical, professional, and managerial topics. Needed courses or course modules can be arranged through external educational institutions or sector training centers; or, they can be developed and offered internally by an in-house training department. Specialized training opportunities in managerial and professional/technical areas related to road maintenance often do not exist in a country. Therefore, special initiatives may be needed to make the necessary arrangements with the appropriate educational institutions. In undertaking such initiatives, it is important to remember that this kind of training should not be academic. It should be practical, job-related, and focused on essential skills.

**African Experiences**

*Increasing incentives and staff motivation in Kenya:*

The Minor Roads Programme of Kenya has used a number of schemes to motivate and retain staff in the program. All permanent staff, for example, are regularly informed of the available promotional opportunities.

To ensure the financial viability and success of labor-based construction programs, it is fundamental to maintain high labor productivity. An assurance that wages will be paid promptly can be a strong motivating factor. In addition to fixing a wage rate able to attract a labor force and commensurate to production, it is important for workers’ motivation that they be paid on time. Nothing lowers the morale of workers more than delayed payment. The program ensures prompt payment to workers for work performed.

Utilization of labor-based methods for road construction and maintenance is a developing technology. The Ministry of Public Works has recognized this by setting up a Technology Unit and a Minor Roads Training School. The Technology Unit was established to investigate various technical and organizational aspects of the Minor Roads Programme and determine required responses and also to coordinate studies being undertaken by consultants. Results of the unit’s work are disseminated in the Program through revisions of the Technical Manual, courses, and seminars. The Minor Roads Training School is geared specifically to the training and retraining of personnel in the minor roads program. It undertakes both theoretical and practical courses and for the latter, operates construction and maintenance sites. The school intends to use its facilities to train personnel in the rest of the Roads Department. To enhance management skills of senior ministry personnel, the school, in cooperation with donors, has also undertaken special workshops based on Goal-Oriented Project Planning. In addition to these workshops, senior personnel have been attending short seminars and courses both inside and outside the country.
Introduction

This paper concentrates on issues involved in improving the ability of road maintenance institutions to make effective use of their human and financial resources.

The inefficiency of the transport sector in Sub-Saharan Africa is a major impediment to Africa’s economic growth and international trade. Systems suffer from inadequate maintenance, burdensome regulations and inefficient operations, resulting in high costs and unreliable services. Personnel are relatively untrained and modern managerial practices are sometimes in conflict with social traditions. The situation is made more acute by the absence of indigenous institutions capable of addressing these problems. Greater efficiency in the sector needs to be achieved through improved policies and management of the technical capacity of its institutions.

Major investments in the past have emphasized civil works and equipment rather than the organization and management of institutions. The region has not developed the institutional and human capacity to operate and maintain its transport infrastructure and services. The absence in many countries of active pressure groups precludes great concern about road conditions at the political levels of government. Some maintenance agencies are used for unemployment relief, and there is no reason, to expect that efficiency goals will rank high in the agenda of such organizations.

Despite efforts to improve operational and administrative performance, it has been difficult to establish self-sustaining institutions that can manage road maintenance efficiently or use external resources effectively. Lacking proven formulae, institutional development has had to proceed by experimentation.

It has been a slow process, taking longer than implementation of more traditional projects. The most successful attempts have been those in which institutional development has taken place over long periods, usually several decades, in the course of several investment projects.

In the case of highways, the main difficulties have been with maintenance because of its managerial and organizational complexity. Institutions that were strong initially progressed faster than weak ones, and agencies that were not fully convinced of the need tended not to support them.

It is much easier to build a new road than to maintain existing ones; similarly, procurement of maintenance equipment has usually been a simpler and quicker process than its management and operation. In general, planning and coordination have been among the most difficult areas in which to achieve acceptable levels of performance.

Accountability and Motivation

Institutions must strive to be both effective and efficient. Effectiveness measures the capability of an institution to define, agree on, and meet appropriate operational objectives. Efficiency, on the other hand, refers to the way in which resources are used to achieve those objectives.

One approach to increasing efficiency and effectiveness has been to attempt to increase individual and collective accountability and motivation within organizations. These are difficult concepts to quantify, and it is difficult to measure success in these areas in anything other than general terms. To overcome this problem, Israel (1987) suggested focusing on two factors he termed "specificity" and "competition".

Specificity is defined as the extent to which it is possible to specify for an activity the objectives to be obtained and their time frame, the methods of achieving those objectives, and the ways of controlling and rewarding achievement. The definition extends to the effects of the activity, in terms of how long it takes for them to become apparent, the number of people and activities affected, and the likelihood of tracing the effects. Thus, the more specific an activity, the more inputs, performance, and outcomes can be measured and organizations and their staff held accountable for results.

Competitive pressure, on the other hand, is a mechanism for setting standards that organizations and their staff must meet. Competition is defined more broadly than in traditional economics; in addition to external competition from others, competitive pressures can be exerted on an organization by the political establishment, regulatory agencies and road users, and by managerial measures that create a competitive atmosphere within the organization.

Low specificity and a lack of competitive pressure are
often characteristics of a poorly functioning institution that has little accountability and low staff motivation. Several steps can be taken to raise specificity:

**Objectives** should be set in terms of output and defined with as much precision as possible.

**Time** periods for meeting objectives should also be closely defined. Longer time periods usually imply lower specificity and a greater likelihood that an activity will be affected by the vagaries of human behavior or political processes.

**Methods** for achieving objectives can affect their specificity. Vaguely defined methods for which there are only general standards imply that it will be difficult to measure performance and efficiency.

**Control** of achievement is a result of the ability to specify objectives and methods, and thus verify achievement. It requires collecting data and information; controlling achievement is easier with high specificity activities.

Israel notes the relative lack of success of maintenance and prevention programs in low specificity activities. The effects of poor maintenance and lack of preventive works take a long time to materialize, and the consequences are sometimes difficult to link back to a specific activity. In the short term, little happens. The lack of an obvious impact is at the heart of the difficulty of promoting maintenance activities in developing countries. There are no inauguration ceremonies for good maintenance. With respect to competition, the main issue is the degree of monopolistic control exercised rather than public or private sector involvement in road works. Contract maintenance is only likely to perform more effectively than force account (direct labor works) if a contractor is subject to competition. A parastatal operating in a monopoly position has few more incentives to perform than a government maintenance organization. It should be noted that the skills demanded for maintenance department personnel will be very different when carrying out maintenance in-house than when managing maintenance by contract.

Cox (1987) has described how competition introduced into public sector maintenance organizations in the United Kingdom resulted in a dramatic increase in efficiency and effectiveness. While there are lessons to be learned from this experience, there is also scope for introducing surrogates for competition. Three types of surrogates for competition can be identified:

**External pressures** from the political establishment or regulatory bodies;

**Internal competition** among staff or units within an institution.

The first surrogate involves beneficiaries who can take action to demand higher standards of performance. This pressure can be exerted on the private sector, but is particularly relevant for public sector agencies not exposed to the marketplace. In some countries, road federations with vested interests have acted as pressure groups on government road agencies. Where such groups are well organized, they can exert considerable influence.

The second surrogate, political pressure, emanates from government officials and regulatory agencies. If well directed, this type of pressure can have a positive effect on institutional performance.

Pressure from both beneficiaries and politicians in the roads sub-sector has too often pushed for building more roads rather than for better maintenance. Attitudes need to change so pressure can be targeted at the right areas. In many countries, there remains a need to mobilize pressure on road organizations from both the political and road-users sectors of the community.

Internal competition involves an entity's developing an organizational and management style that generates competition among its personnel and units for better performance. The need to increase the specificity of activities is particularly relevant here.

The effectiveness of competition and its surrogates may be limited by cultural conditions. Competition increases the potential for conflict, which can raise difficult situations for management. In societies in which collaboration and the avoidance of conflict are paramount, introducing competitive measures can be counterproductive and the relevant factor may be collaboration rather than competition. Deciding where to keep old arrangements and where to instigate change is a difficult process that few societies have accomplished successfully.

Competition works by threatening an organization and forcing it to adapt in order to survive. Public sector enterprises do not, however, control many of their basic policy parameters, so survival may depend on a change in government policies. Often these policies are overloaded with so many diverse objectives that none of them can be met efficiently. Governments will sometimes need to alter their policies if enterprises are to survive in a more competitive environment.
Organizational Change

Three steps are needed to make the organizational changes necessary to increase accountability and motivation to improve road maintenance institutions: obtaining government commitment; isolating and analyzing problems; and developing and implementing action plans.

Commitment

Greater public awareness, including that of potential interest groups such as road haulers, exporters, and contractors, is important for shaping policy and mobilizing support for programs to restore and maintain roads. Political and private interests have often brought pressure on road authorities to divert resources intended for road maintenance. This has led to maintenance organizations starved for finance and shunned by the ablest civil servants, with the result that the maintenance function suffers from neglect.

Those at high political levels must grasp both the importance of maintenance and the necessity for the efficient use of resources. The consequences of road neglect are a matter of public interest. Awareness should be created among the general public and potential interest groups. This should be focused on not only the bus and haulage companies, but also on business more generally, including potential vendors of road maintenance supplies or services, in the hope of stimulating a coalition of interests to influence public policy.

Governments can also foster interest in the road maintenance problem and the need for institutional development by encouraging the formation and functioning of professional associations of highway engineers. Such professional institutions often include influential senior government officials and can influence the formulation and execution of policy. The Institution of Highways and Transportation in the United Kingdom is endeavouring to build institutional links with similar bodies overseas.

Political and cultural considerations can prevent pressures generated in the private sector from being taken up by governments. For an action plan to have a chance of success, there must be a combination of political and public pressure for reform. Unless ways can be found to combine these pressures and internalize them within the government it is unlikely that progress will be made. Thus, where cultural constraints exist, committed politicians will need to find ways of fostering interest groups and raising awareness of needs within government circles.

Even with strong public and political commitment to tackle the problems of institutional development, resistance to change is likely to be a difficult obstacle to overcome. Where maintenance procedures have evolved over many years, staff are likely to see their chief problems as lack of resources rather than maintenance management. Promotion is likely to depend on a well-extended system of local loyalties which may well be stronger than headquarters policy. Many hundreds of staff are likely to be affected by any decision. Against this background, revision of maintenance procedures is likely to take a long time, during which political commitment and continuity will need to be maintained.

Analysis

A thorough understanding of an institution—how it works, its strengths and weaknesses, efficiencies and bottlenecks—is needed before it can be strengthened. A first step must therefore be an institutional appraisal. Although there are some advantages to this being performed internally, experience suggests that it is usually more effective if management reviews are carried out by external consultants or an institution that can introduce new ideas and experiences, and is freer to recommend the more difficult changes that would be a problem for insiders.

Institutional appraisal is difficult. Political and cultural issues will be important, and the way an institution works in practice may not be what is said formally and is often obscure to the outsider. It will be essential to work closely with the institution concerned and those to which it is responsible. It will also often be necessary to draw on specialist advice.

An approach to institutional appraisal has been provided by the British Overseas Development Administration (ODA), which has developed a series of checklists for institutional appraisal, financial management capability, and manpower planning. The ODA institutional appraisal checklist covers both the institution itself and the environment in which it operates.

The Transport and Road Research Laboratory has developed a checklist specifically for assessing road maintenance organizations in terms of their "institutional", "managerial" and "technical" capabilities. The interdependence of these assets can be better understood if these terms are defined.

Legal/institutional capability: Developed economies have legal frameworks that clearly define the responsibilities of government ministers and their departments. This is not always the case in developing countries, with the result that considerable reliance may be placed on a senior office-holder's interpretation of his powers and responsibilities, and changes in senior staff may result in new interpretations and lead to confusion and lack of commitment amongst middle and junior management. It is fundamental to the establishment of an
efficient highway maintenance department to have statutes that define the department’s responsibilities clearly and provide for:

- legal powers to undertake maintenance;
- rational and functional administrative structure;
- the employment and training of staff;
- funds to undertake maintenance and for administration, salaries and expenses;
- financial control.

Managerial capability: Management must concentrate on efficient use of human and physical resources with a clear understanding of the role of the department and its goals. Managerial capabilities require:

- up-to-date inventory;
- works effectively planned, programmed and monitored;
- budget related to actual costs and ability to disburse;
- effective cost control;
- adequate plant and equipment that are effectively utilized;
- availability of materials as required.

Technical capability: Without technical resources, an institutional framework and management expertise are of limited value. Sufficient numbers of competent staff at all levels are required by any organization. Lack of competence, at any level, will affect efficiency, but it is particularly important at the lower levels of responsibility for plant operators, technicians, mechanics and laborers. The technical capability requirements for efficient maintenance management are:

- appropriate criteria for planning;
- materials test facilities;
- effective quality control of all operations;
- implemented pavement assessment and monitoring systems;
- access to research and information.

The checklist demonstrates the interdependence between institutional, managerial and technical capabilities. For an organization to be effective, satisfactory performance in one area cannot be achieved without complementary capability in the others. Each element must be in place in the road maintenance organization if improvements are to be sustainable. It may be that too much attention has been paid in the past to improvements in technical capability without first ensuring the institutional and managerial competence to support it. In many countries, straightforward and relatively short-term assistance to upgrade technical capability may be appropriate, but only if institutional and managerial performance is sufficient.

It seems likely that improvements at the institutional level are prerequisites to improving management and technical capabilities. Checklist results tend to support this hypothesis, since most of the road maintenance organizations that have been evaluated failed to achieve a high enough institutional score to provide the basis for investing in managerial and technical improvements. Thus, a hierarchy exists in that sufficient institutional capability is required to support and sustain managerial capability which, in turn, is a precondition for sustained improvements in technical competence.

The checklist is subjective and responses to it refer only to a particular point in time. However, it is believed that such a checklist can greatly assist in defining the areas of an organization that are deficient, and ensuring that institutional development efforts in the maintenance sector have the highest chance of success in the longer term.

**Action Plans for Institutional Reform**

Once the needs of the organization have been identified through an institutional appraisal, the next step is the development of action plans, and their implementation and monitoring. Data collection and analysis must form an integral part of each of these tasks.

A well-defined action plan should be realistic and achievable, have a series of targets related to different stages and times, and be monitorable and monitored.

Most components of an action plan will address issues internal to the organization, but some will need to address external factors. Addressing external factors is likely to prove more difficult and to take longer, but these should be tackled in parallel.

The internal factors to be considered include organizational structure, policy and decision making patterns, procedural factors, physical resources, and information systems. The external factors to be considered include both economic and socio-political issues.

Strengths and weaknesses in these areas should be identified through the institutional appraisal which should rank issues by importance. The institutional-
managerial-technical hierarchy between issues should be recognized as this will lead to a logical sequencing.

The institutional appraisal will investigate aspects of the organization such as responsibility, authority, duty, and delegation as well as its specificity and use of competition surrogates. It will comment on whether the organizational form is appropriate to the tasks that need to be carried out, taking account of the socio-political environment in which it is operating. Action will be needed to implement any changes in the organizational structure resulting from the institutional appraisal.

The institutional structure should be designed to increase specificity and make the best use of resources. Formal criteria need to be established for allocating resources within the organization.

A number of weaknesses common to Sub-Saharan African road maintenance organizations could be the focus of action plans. Among economic issues, resource shortages suggest that many regional countries should adopt policies geared to better utilization of existing facilities and to the more effective provision of maintenance services. This should be done through more cost-effective resource allocation, reduction in overstaffing, and improvement in the management of maintenance organizations.

Resource Allocation

Economic analysis should be the basis for allocating resources between new investments and maintenance but decision criteria should take into account social and other national priorities. In most cases, maintenance activities will have the highest economic returns and the bulk of available resources should be allocated to maintenance.

Given the size of existing road networks and the lack of resources, it is unlikely that many countries in the region will be in a position to maintain the whole of their road networks. Each country should establish a core network that it can afford to maintain under the national budget and set up a program to increase the size of this network gradually as financing improves.

Each country should develop a sector transport plan of projects for which it would require donor assistance. Funding should then be sought from donors for these projects and pressure from donors for other projects should be resisted, even where funding is offered on a grant basis. External financiers should be more sympathetic than previously to such an approach and should be more prepared to fund maintenance and rehabilitation, and to employ local contractors for such activities. Attempts by donors to set up special facilities for their projects should be resisted because of the distortions such activities cause.

Staffing

In some countries, government organizations have, in essence, become agencies for employment relief. Large, relatively untrained labor forces have been allowed to develop with the result that available funds can only cover the cost of salaries with little remaining for the materials, fuel and other resources necessary to carry out works. Civil service rules circumscribe managerial decisions and national employment objectives can smother the authority’s technical work and distort its operations. This results in a workforce that has little motivation. Attempts should be made to address this issue by modifying government policy on civil service employment to enable reductions in the size of the unskilled workforce with more emphasis on the development of skilled labor.

Shortages of technical staff and inadequate skills should be recognized and reflected in the organizational structure. Rather than use well qualified staff on a construction site when there is a lack of skilled staff in the maintenance department, it might be better to use high quality staff for maintenance planning and management activities and hire consultants to supervise construction works. Using staff in this way recognizes that it is cost-effective to delegate responsibility for relatively short-term and geographically isolated tasks such as contract supervision. Such situations must be recognized by decision makers and formal modifications made to organizational structures to reflect optimal solutions.

Institutional Management

In a highway maintenance organization with a pyramidal management structure, successful operation is utterly dependent on instructions being passed down the line and sensibly interpreted at each level. A disciplinary system usually exists to back up orders, but this is normally only used as a last resort. In a Western maintenance organization, the knowledge that disciplinary measures can be invoked provides an incentive for operational efficiency, coupled with the more positive incentive of promotion based on good performance. If traditional or cultural considerations make incentives and sanctions ineffective, management efficiency is severely impaired.

In practice, conditions on the ground are such that excuses can frequently be found for inefficiency that tend to obscure the basic problems of management. No attempt to deal with problems will be really successful unless it takes full account of these traditional behavior limitations. Formal, objective and systematic staff assessment is the only real means of showing to an individual and his superiors that he is worthy of promotion. Without this competition surrogate, nepotism and favoritism could well be perpetuated to the detriment of staff morale and efficiency.
A maintenance organization should have clearly defined policy objectives. These should be specified in output terms so it is possible to measure achievement against them. Objectives can be stated in terms of the maximum or mean levels of road roughness allowed, or in terms of the percentage of the network that should be ressealed or regravelled each year, or in terms of how measured road conditions are planned either to improve or stabilize over time. Such well defined objectives increase the specificity of the organization and provide a target, which should be the starting point for all planning and management activities within the organization. Considerable thought should be given to formulating these in ways that are both meaningful and achievable.

Decisions within the maintenance authority should be based on rational criteria that are documented, well known and understood by all managerial and operational staff. Criteria should reflect the policy objectives of the organization. In addition, criteria should be framed so resources are utilized in the most cost-effective way and with the object of increasing accountability and motivation by addressing the issues of specificity and competition. The formulation of decision criteria, like objectives, should be a conscious and rational act.

Decentralizing the organization of road maintenance has often been advocated as a first step in reform. Decentralization is seen as a way to make the road maintenance authority more responsive to local needs and reduce the difficulties of managing activities that are geographically dispersed. The re-emergence of lengthmen for undertaking maintenance on unpaved roads in several African countries has come about in direct recognition of this. However, in organizations that are managerially weak, decentralization imposes additional managerial and technical burdens that may prove difficult to support. Case-by-case experimentation in this area is recommended to determine which organizational form is most appropriate.

The level of specificity can be increased by separating the planning and control functions of road maintenance from that for works execution. By limiting demands on these management functions, the road authority is less likely to be overwhelmed with executional priorities, and accountability can be strengthened. The experience of the United Kingdom is particularly relevant in this context. The separation of maintenance functions can be achieved in three areas—equipment management, maintenance execution, and maintenance management.

Equipment Management

Equipment is one of the most costly resources in road maintenance, yet availability and utilization are extremely low, often no more than half of reasonable norms. There is scope for improving the management of equipment by considering issues of specificity and competition.

An increased level of specificity can be introduced by managing equipment through a departmental plant hire scheme. By compelling explicit accounting of costs, such schemes inculcate greater cost consciousness and generate pressures within government for efficient utilization of plant and vehicles, helping to control diversion and curtail excess and unaffordable investment. By making the finances of plant hire organizations dependent on revenues generated from plant hiring, strong incentives can be generated to keep plants in operation, since a broken-down plant generates no revenues. Spare parts can also be replenished regularly and equipment replaced out of revenues generated.

If such a scheme is to work well, the public administration must resist pressures from equipment users to understate costs and ensure that bills are paid. If not, funds generated will be neither adequate nor available on a timely basis, and the true costs of equipment will remain hidden.

Competition can be introduced by allowing the autonomous equipment department to compete on equal terms with plant hire companies in the private sector. Such an approach needs careful accounting and audit to ensure that there are no hidden subsidies. A further approach is to turn entirely to the private sector and/or to privatize the equipment maintenance function completely.

Maintenance Execution

The effectiveness of maintenance can also be enhanced by introducing competition into execution operations, either by allowing a public sector maintenance enterprise to compete with the private sector, or by complete privatization. Creating a separate maintenance enterprise that still enjoys a monopoly position is unlikely to provide the full advantages, although efficiency and effectiveness are still likely to be increased because of the higher degree of specificity.

The possibility of contracting a major part of routine as well as all periodic maintenance should be considered, but care must be exercised to ensure that the public monopoly is not replaced by a new cartel of private interests as has happened in some countries. Careful planning and introduction of contracts on a small trial basis can reduce risks, permitting the government and contractors to develop capabilities before putting too heavy a burden on a new system. Successful contracting schemes have involved close coordination between governments and contractors in defining the work to be done and in planning the work program. A further advantage is that when contractors become involved in
maintainance, their lobbying efforts can increase budgets for road maintenance.

In principle, there is no reason why the planning and control functions of maintenance operations cannot be subject to competition in a similar way to the execution of maintenance. Although there is limited experience with this in developing countries, its adoption for certain maintenance works in Britain has led to a 15% reduction in management costs. The work involves routine, periodic and emergency maintenance and includes surveillance, inspections, investigations, determination of priorities, and the supervision of all work on the network. Contracts were placed with consultants, after competitive bids, for a five-year term.

Many members of the existing maintenance workforce transferred to the consultant’s staff upon the award of contracts, so this approach provided competition and increased levels of specificity without significant job losses. There is believed to be considerable scope for this approach to maintenance management in developing countries, and its use is recommended, at least on a trial basis.

Without physical resources, very little maintenance can take place. Some resources rely on foreign currency; others are dependent purely on local currency, and it is important for decision-makers to be aware of these differences when determining policy and formulating plans. Awareness of resource limitations can be taken into account by formulating plans that minimize the use of resources that are likely to be scarce.

In many road maintenance organizations there is a shortage of transport, either because of a lack of vehicles or because of a lack of fuel or vehicle repairs—which in turn, is often caused by an absence of spare parts. The effects of transport shortages can often be mitigated to a large extent by adopting a decentralized policy that minimizes transport distances. The use of maintenance camps and lengthmen becomes very appropriate in this context.

Endemic shortages of bitumen may mean that, for some roads of lesser importance, it is appropriate to rip up badly deteriorated paved surfaces and return them to a gravel surface to allow them to be maintained. Similarly, shortages of gravel may indicate that some roads should revert to an earth surface. In both cases, limited physical resources should be targeted on the more important roads. This should be the result of a policy decision rather than something that happens by default.

Technical Assistance

It is likely that technical assistance will be needed at some stage. Even if execution or management is carried out by contract, there is still likely to be the need for assistance in the institutions of government in setting policies and supervising maintenance activities.

The changing form of development efforts in Africa over the last 10-15 years has implications for the type of external expertise required. Through the mid-1970s, development was essentially the preparation and implementation of development projects, and much of the assistance required for these tasks came from engineering and other technical consultants. Although the problems faced were often technically complex, the nature of the consultants tasks was relatively easy to define and outputs were tangible. Performance was clearly measurable, though its monitoring was often weak.

The development focus over the past years has been shifting to the strengthening of institutions, the management of technological and social change, and the study and implementation of policy reform. These new directions have important consequences for the way a country manages technical assistance, for the nature of the relationships to be established, and for the types of expertise required.

Effective use of technical assistance in the past has sometimes been hampered by inherited institutional systems that retained in top positions generalists who did not always appreciate technical requirements and were sometimes a barrier between technical specialists and decision-makers. Technical assistance has also acquired a bad image; the pay scales of expatriates are common knowledge and national civil servants are unwilling to accept the large discrepancies in salaries and fringe benefits. Ways must be found to provide incentives for local counterparts, such as providing opportunities for secondment to equivalent organizations abroad or regrading staff.

The use of counterparts has been an issue in implementing technical assistance programs. Assignment of good counterparts to work with consultants is vital for success; however, it has been difficult to find or to attract counterparts with the right experience and commitment. Often counterparts are assigned only a few weeks before the end of an assignment. When suitable and sufficient counterparts cannot be found, experts in advisory positions with responsibility for on-the-job training end up as doers rather than trainers. There seems to be merit, therefore, in viewing the expert as the counterpart of the local staff, rather than the reverse. Another approach used by some countries is to let consultants take part in the selection of nationals working with them.

Most countries in the region have reached a mature stage in the use of technical assistance, and are using it selectively and far more effectively. Governments, therefore, should not be discouraged by the failures and
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the bad image of earlier times. However, it is probably not wise to go too fast with the replacement of expatriate personnel. Young professionals with only two or three years experience should not be expected to move straight into managerial positions.

Sometimes, it may be best to use technical assistance in executive rather than advisory positions since this increases the level of specificity. In the traditional advisory role, the technical assistance officer has only indirect responsibilities for measurable outputs, very limited risks and, at best, limited incentives for improving performance. To provide performance incentives, the role of the technical assistance officer needs changing to better apportion the risks between providers of technical assistance and government clients. Traditional sources of technical assistance are often not well structured financially to accept significant risks. There may therefore be scope for looking at other sources of road maintenance assistance, such as international civil engineering contracting companies. Such companies usually have staff with appropriate experience and qualifications, and are accustomed to working as management teams in developing countries. Construction companies are accustomed to risk-taking and providing performance-related incentives.

If institutional development is to be successful, a change of emphasis is needed to make technical assistance the main focus of projects, rather than an ancillary item. Such an approach is likely to be a natural outcome of institutional appraisals, but will need a change in perspective by both African governments and international aid donors.

The twinning of institutions in developing countries with similar, but more mature, organizations in other parts of the world has proven an effective way to transfer knowledge, train staff, and build management capabilities. Professional relationships between operating entities offer advantages of being complementary and are flexible over time. The entity supplying technical assistance uses its own resources to offer services to its twin in the functional areas in which they both work.

Twinning arrangements in the highway maintenance field have been carried out between the US Bureau of Public Roads and authorities in Ethiopia and, more recently, between Staffordshire County Council from the United Kingdom and Accra City Council in Ghana. Where twinning arrangements have been successful, there has always been an initial commitment and consensus on the goals of the technical assistance. It is important to recognize that twinning used alone may not be enough and that other types of technical assistance may be needed, and that entities are not necessarily compatible simply because they are in the same business. Both client and supplier may need help in setting up a twinning agreement and working together to carry it out.

Experience with twinning suggests that there is more scope for its use than has been taken advantage of in the past. A tripartite arrangement between a host organization and an offshore institution in conjunction with a consultant seems to offer the best combination of skills and resources for solving institutional problems and assisting with development. Any twinning arrangement considered should follow closely the guidelines set out in World Bank Technical Paper No. 23.

Monitoring

Any action plan should be both monitorable and monitored. Well-defined, output-oriented objectives need to be set at the outset and achievement at specific time periods measured against these objectives. There is some advantage to carrying out monitoring by an independent body. The other purpose of monitoring is to identify areas where changes may need to be made, both to the objectives to the methods being followed. However carefully an action plan is formulated, lessons will be learned factors to be reflected in a modified plan.

Monitoring the performance of road authorities is essential for those who are to be held accountable for maintenance as it is for the audit of their performance. However, it has proved extremely difficult to collect the basic data that enables this to be done. The 1985 and 1988, World Bank surveys of African roads indicated that critical management data are generally not available, and where available are inconsistent or, in many cases, incorrect.

If effective maintenance strategies are to be devised, program planning, control and monitoring need to be strengthened at all levels. The key to effective maintenance is to anticipate needs and this is not feasible without a system of regular inspections of pavement conditions. Many planning tools are available, but their use must be adapted to specific country conditions. Information is required on inventory, condition and traffic, and these data must be collected in a systematic way. The data volumes involved point towards computers as being an appropriate medium for their storage, manipulation and retrieval, but experience with large-scale, computer-based management systems in developing countries has not been encouraging.

Whether maintenance management systems are introduced by management contractors or by the public sector maintenance authority, it is recommended that an incremental approach to implementation be adopted, probably over a period of several years. Guidance to doing this is given in Overseas Road Note 1 (TRRL Overseas Unit 1987). One approach is to concentrate
Richard Robinson: Institutional Development in Road Maintenance Organizations

data collection activities solely on the sections of road that carry the largest volumes of traffic since it is here that most benefits will be obtained. Another approach is to start by defining and referencing the road network, and providing a simple system for recording and storing this information. This can be followed by the collection of itemized inventory information and this, in turn, followed by the introduction of simple visual inspection methods. By proceeding step-by-step in this way, it can be ensured that one stage is working reasonably well, and that accurate and reliable data are being obtained before moving on to the next stage. These approaches stand more chance of success than the rapid introduction of full scale management systems which have been tried in the past.

Conclusion

For African governments to address the problems of institutional development, the following steps are needed to obtain success:

Obtaining government commitment: there is a need for strong political leadership and to foster interest groups and to internalize their effects within the government.

Obtaining a full understanding of the problem: this should be done by carrying out an institutional appraisal that collects data and takes cultural issues into account.

Addressing the problem: this requires development of action plans and implementing them by addressing specific policy issues and recognizing external and internal factors; priority tasks should be identified for tackling in an incremental approach that considers the following areas:

- economic issues: better utilization of existing facilities, economics-based resource allocation, identification of priority network, development of transport sector plans and a more positive approach to dealing with donors;
- socio-political issues: resistance to change, employment policy, cultural constraints and the need for objective staff assessment;
- organizational structure: organizational form, formal criteria for allocating resources, centralized or decentralized organization, separating functions for equipment management, maintenance execution and maintenance management;
- procedural factors: setting policy objectives, determining criteria for decision making;
- physical resources: foreign exchange effects, shortages of transport and maintenance materials;
- formulating projects in terms of institutional development rather than physical execution of works;
- monitoring achievement.
References


Background

Massive road investments to link cities, ports, industrial and rural areas have greatly outstripped Sub-Saharan Africa's ability to provide the trained manpower needed to maintain and repair them.

Road maintenance has been only one of many claimants on the region's overstressed education and training facilities. When these countries gained independence beginning in the 1950s, trained indigenous manpower was virtually non-existent. In Malawi in 1964, for example, there were only 29 African university graduates, none of them in engineering. When Botswana became independent, 96% of higher level posts in the country were filled by expatriates, and non-Africans occupied all posts requiring a university degree in Tanzania in 1962.

In most African countries, the grace period for transition was short. Some were reluctant to accept a lengthy transition for the replacement of expatriate senior, middle-level and supervisory staff by local personnel. In others, the rapid and complete departure of the colonial powers gave little choice but to place untrained and largely inexperienced national staff into responsible posts without delay.

The burden of training replacements for the departed expatriates fell on education systems that were often rudimentary. Only 36% of the region's children were receiving primary education in 1960, compared with 73% in Latin America and 67% in Asia, and more than 90% of the Sub-Saharan African population was illiterate. At the secondary level, average enrollment was 3% compared with 14% and 21% respectively in Latin America and Asia. Only one in a thousand went on to enroll in tertiary education, compared with more than 30 times this rate in other parts of the developing world. There have been significant changes since independence, and literacy is approaching 50%. Primary enrollment in 1985 was 75%, secondary 23%, and between one and two% progressed to tertiary education, but these figures are still well below those for industrial countries, where almost 40% receive tertiary education.

Despite these advances, specialized personnel remain in woefully short supply. It is generally agreed that a minimum of about 30 graduate-level engineers and scientists per 10,000 people are needed to service a modern economy. In most Sub-Saharan African countries, the proportion is less than a third of this number. By this standard, the estimated 10,000 suitable engineers and scientists being produced each year by the region are not even enough to keep up with annual population growth of some 13 million.

In spite of the progress made and its increasing cost to local economies the education gap between the Sub-Saharan countries and those of the industrialized world is large and increasing. In 1960, the industrialized countries spent 14 times more per student than the poorer developing countries. By 1980, this figure was 50 times more. With this worsening situation, it is essential that education and training in the Sub-Saharan Africa region is planned to provide only essential and urgently needed skills; that the quality of instruction is the very best possible with the resources available; and that costs per person trained are kept to a minimum. The need is not so much for more education, but for more relevant education designed carefully to meet the specific manpower requirements of the region.

The improvements attained over the past few decades are now threatened by steeply rising costs for secondary and tertiary education and specialist training. Falling per capita GDPs over the past few years have only accentuated this problem. In tertiary education, average annual costs per student in the region are about eight times the average per capita income, as compared with only about 90% of per capita income in Asia and 70% in Latin America. Countries with small or widely scattered populations face additional difficulties, as tertiary training institutions are often uneconomically small and it is not possible to have the wide range of specialist training institutions that are needed.
The Development of Human Resources

The need for more education and training in Sub-Saharan Africa is universally accepted. Training is, however, frequently regarded as synonymous with human resource development, and insufficient attention is paid to establishing a framework of priorities to assure that training is cost-effective and result-oriented. This means that too little attention may be given to manpower analysis before training is planned, or to manpower management after training has been completed. Insufficient analysis of manpower resources and needs carries the risk that the wrong type of training may be given, or that people are trained for jobs that are of low priority or do not exist. Poor manpower management means that trained staff are unable to apply what they have learned effectively, and their training is wasted.

Manpower analysis and planning is an essential first step toward developing the supply of human resources needed for effective road maintenance programs. While national manpower planning, apart from being expensive and difficult to organize quickly, often results in insufficiently detailed data, sectoral analysis often produces accurate and practical results that can be used to identify potential skill shortages and imbalances that hinder the achievement of sector goals. These analyses can also identify priorities for training programs and suggest possible institutional changes. By taking a sector-wide approach to training, programs can be developed to meet the specific needs of the sector, and are thus likely to be more cost effective than generalized educational and training programs. A promising approach has been taken by the World Bank in Ghana, where local organizations active in the sector have been enlisted to collect data that is compiled and analyzed centrally for a sector survey.

National education systems are not, and should not be, programmed solely to meet the needs of the roads sector. The appropriateness of curricula to developing the basic practical skills needed by roads and other productive sectors should, however, be a national educational priority in countries with severely limited resources to spend on education. The results of sectoral manpower needs analysis should be made available to education planners to assist in establishing those curricula.

Despite the fact that significant advances have been made in primary education, it is open to question whether the type of education given even at this early stage is entirely appropriate. The whole bias of general education at all levels has been towards academic qualifications. This produces expectations for types of employment that do not exist in sufficient quantity, while there is a great need for other types of skills. A fundamental issue which affects all development in the region is not merely the provision of education, but provision of the type of education appropriate to the needs of the society and the economy. Providing education which does not lead on to suitable employment is a recipe for frustration and unrest, as well as being a waste of scarce resources. The education systems in many regional countries are unsuitable, at least to some extent, to the pattern of their economic development. It will now be difficult to recorient the expectations of those who have passed through these systems towards the type of employment opportunities that do exist.

Road maintenance requires a range of very specialized technical skills at the lower- and middle-management levels, while higher management also needs well developed managerial skills. These specialized managerial skills are not taught at most African colleges. The need for specialized regional centers to provide these skills has been recognized through the establishment of such institutions as the Eastern and Southern African Management Institute (ESAMI) in Arusha, or the Regional Management School for the West African Economic Community (CESAG). Institutions such as these have a great potential for tackling more effectively than training centers outside of Africa some of the critical human resource constraints of Sub-Saharan Africa. These institutions face, however, the difficult twin tasks of keeping up to date with worldwide developments in management training and adapting these to the particular needs of their African students. Donors can help in this process by giving relatively inexpensive assistance in the shape of short-term consultancies, technical publications, teaching aids, testing and survey equipment, and, perhaps most importantly, advice on—and training in—new methodologies.

Road maintenance staff often need highly specialized short-term training that can be most cost-effectively delivered by bringing trainers to their clients. Travelling instructors can be used to present highly specific short courses to relatively small and specialized groups in individual countries or regions. This method of training has the advantages that course content, length, and the number of instructors can be varied to suit specific needs, travel and subsistence costs are lower, and staff are away from their normal duties for a shorter time, if at all. Overall, the costs per trainee are less for traveling courses, and course material can be made very country specific. There is often an added advantage in that trainers brought to the field receive significant feedback from clients that can help to adapt training to working level needs.

To organize this type of very specific and concentrated training in the best way, the duties of the staff to be trained need to be analyzed to ensure that all essential work is covered, and the minimum of unnecessary material is included. As an example of the scale of savings
that this approach can produce, in training large numbers of construction workers in one Asian country, it was found that basic skills sufficient to train for over three quarters of normal work requirements could be imparted by using less than 20% of conventional course material. As a result, training which had previously taken two years was completed in ten weeks to the stage where the majority of construction work could be tackled competently. Training in higher skills for more advanced work was then provided by further short courses after a year or two of employment with on-the-job training.

Much has been written on the subject of loss of trained staff, particularly as it affects government. While this loss is undoubtedly an annoyance and an inconvenience to an employer who provides training, it is not necessarily a loss to the country as a whole. If trained staff move from government to the private sector where conditions are better—as is very commonly the case—the training provided by the government will eventually improve the capabilities of the private sector. In this case, and unless the conditions offered can be matched by the government, the best course may be for the government to make the maximum use of the private sector, thus reducing its own need for trained staff. Direct government investment in private sector training may even be warranted in countries in which a stronger private sector offers the possibility of efficiency gains, reducing public sector management burdens, or providing competition that will increase public sector effectiveness.

**Manpower Management**

Trained manpower is a scarce and expensive resource that must be used sparingly and efficiently. Well designed and well managed institutions are necessary to attain this goal; staff skills must be used to the maximum, and staff must feel they are making a real contribution to the efficiency of the operation. In some Sub-Saharan countries, the roads authorities have made significant progress towards such a happy state of affairs—often in spite of very limited resources and continual outside interference in technical operations. By contrast, in the roads authorities of other regional countries, one finds senior technical management involved in every minor decision so that they are unable to give time to policy matters, middle management doing largely clerical and administrative work while work planning and supervision remains undone, and junior staff often idle because the necessary planning, transport, materials, tools and equipment are not available. Morale is low and there is neither incentive for good performance nor disincentive against bad performance. Not surprisingly, productivity is abysmally low under these conditions.

In some cases, these situations result from institutions designed and set up according to non-African ideas. If the precepts on which an institution has been designed to operate do not accord with the accepted ideas of the society in which it operates, it is unlikely that very efficient functioning will result. Where roads organizations are operating reasonably well in Sub-Saharan Africa, it is likely there has been some accommodation of one to the other.

For the foreseeable future, regional countries will have to continue to make significant use of consultants to provide expertise not available within their own organizations. The achievement record of consultants, and technical assistance generally, in Sub-Saharan Africa is mixed. Where consulting firms have been used on specific and well defined projects, results have usually been satisfactory, but where the aim has been to build institutional capability by technology transfer, there have often been doubts as to whether consultancies were cost-effective. The problem seems to arise in these cases from a failure to define exactly what is required from a consultancy, with target outputs and timing left vaguely defined, and a subsequent lack of monitoring to make sure that specified objectives have been reached. The solution is to spell out in the terms of reference for assignments, exactly what is expected in terms of institutional development and staff skill improvement, as defined by a manpower and institutional analysis. It should also be made clear that continuation of assignment depends on targets being met on time. These comments apply to both consulting firms and individuals provided under technical assistance agreements, although enforcement is more difficult with the latter. For their part, donors could well cooperate to see that the technical assistance they provide is well planned to give what is needed without overlap or gaps. It has been the practice to assign counterparts to work with consultants to encourage the transfer of knowledge. Although sound in theory, this idea often achieves little, and there have been faults on both sides. On-the-job training, of which this is one type, takes time and energy on the part of a consultant, who needs to have a genuine desire to develop his counterpart. The qualities necessary to instruct are not the same as those needed to design, advise or supervise, for which the consultant is generally chosen. Counterpart training should be regarded as the primary objective of the consultants' assignment, and not as a subsidiary part-time activity.

On the part of the government, counterparts are often assigned late, or only temporarily, to consultants, and they may not be suitable for the type of training given or for the post they may later hold. To be effective, the counterpart should be assigned throughout the consultancy period, and must have the knowledge and
capability to develop to the required level. There must be incentives for development, and counterparts should be able to see that they will eventually be engaged in the position for which they are being trained, and will be able to apply the expertise they have acquired. Best results are likely if, as quickly as possible, the roles of consultant and counterpart are exchanged, with the consultant filling a largely advisory position.

Without some form of transfer of knowledge, aid projects have proved to be of limited and temporary benefit. The process needs to continue for a good many years, but most consultancy assignments are too short for this. Twinning between similar institutions in different countries overcomes this problem, as the contact can continue for as long as felt desirable, and costs are low. As with counterpart training, there needs to be a real commitment on both sides of the ideal of effective technology transfer. As well as the two institutions matching, individual positions and their holders should be matched. To be effective, the individuals directly in contact need to build up a degree of empathy over the years so that either party can feel free to make direct contact over day-to-day problems, with the assurance that there will be an immediate and useful response.

Recommendations

Road maintenance organizations, transport ministries, and external donors should recognize the need for increased analysis of sectoral manpower needs and that devoting resources to such analysis may, in the medium to long term, lead to significant overall savings in terms of more appropriate and cost-effective training.

Road maintenance organizations and other operating departments should make information on manpower needs available to national education planners and seek an advisory voice in the design and priorities of curricula at all levels.

Greater attention should be paid to the training of trainers themselves. "Twinning" could happen between industrial country management institutions and such organizations as ESAMI and CESAG.

CESAG and ESAMI should consider establishing training teams capable of delivering short and highly specific courses on site in regional countries. Donor organizations should assist in this exercise.

National manpower planners should examine the possibility of providing training to private-sector road maintenance organizations and contracting firms.

Caution should be taken not to impose inappropriate imported management systems on African institutions. Systems that have worked elsewhere in the region are more likely to be successful, but any system adopted should be tailored to accord with local conditions.

Consideration should be given to providing consultants and consulting firms themselves with training in skills transfer techniques. Twinning between kindred organizations should be explored as a means of developing longer-term skills transfers.
Topic C: Case Study  
Assessment of Maintenance Capability**

Introduction

The World Bank policy on road deterioration in developing countries states that "developing countries have lost precious infrastructure worth billions of dollars through the deterioration of their roads". It also comments that "the inadequacies of road maintenance stem in part from the structure and functions of the traditional road agency."

Projects for addressing deficiencies in the functions of a road agency need to recognize that there are essential differences between maintenance projects and those for new construction or rehabilitation, as shown in Table 1.

Construction projects can be successful and completed to specification and on time by contractual arrangements independent of local resource constraints. Maintenance projects, if they are to result in permanent improvements in performance, demand a thorough assessment of the existing institutional, managerial and technical capability of the maintenance department. Failure to recognize this need in the past by donor agencies, consultants and client governments has resulted in many projects failing to sustain improvements in the long term, or even to meet project objectives in the short term.

It is, therefore, crucial that terms of reference for road maintenance projects be based on a detailed assessment of maintenance capability to ensure that key assessment issues are addressed. This, in turn, requires that the institutional situation is analyzed in far more depth than would be necessary for a construction or rehabilitation project. The result of such an analysis should indicate where external assistance is most likely to promote permanent change and avoid the application of palliatives to problems which are a symptom of institutional and managerial faults rather than the cause of inefficiency.

Assessment of Current Conditions and Project Formulation

A road maintenance checklist has been developed with the objective of assisting those responsible for the identification of maintenance projects in the road subsector in developing countries to assess the capability of local maintenance organizations, and thereby ensure that selected projects address those areas where investment could result in sustained improvements. The checklist is attached and was designed to assess capability in terms of the 'institutional', 'managerial' and 'technical' aspects of an agency. The interdependence of these aspects can be better understood if the terms are described.

<table>
<thead>
<tr>
<th>Table 1</th>
<th>ESSENTIAL DIFFERENCES BETWEEN PROJECTS FOR CONSTRUCTION AND MAINTENANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Construction Projects</strong></td>
<td>Maintenance Projects</td>
</tr>
<tr>
<td>Duration</td>
<td>Tend to be short-term</td>
</tr>
<tr>
<td>Technology transfer</td>
<td></td>
</tr>
<tr>
<td>Consultant's organization</td>
<td></td>
</tr>
<tr>
<td>Door Administration</td>
<td>Straightforward</td>
</tr>
</tbody>
</table>

Assessment of Maintenance Capability - Case Study

Legal/Institutional Capability

In developed mature economies, there invariably exists a legal framework which defines unambiguously the responsibilities of government ministers and their departments. This is not always the case in developing countries with the result that considerable reliance may be placed on a senior office-holder’s or minister’s personal interpretation of his powers and responsibilities. A change in senior staff may result in a different interpretation and lead to confusion and lack of commitment amongst middle and junior management fearful of being ‘out-of-step’.

Fundamental to the establishment of an efficient highway maintenance department is the presence of statutes which define the department’s responsibilities clearly and provide for:

- legal powers to undertake maintenance;
- a rational and functional administrative structure;
- the employment and training of staff of sufficient calibre;
- funds to undertake maintenance and for administration, salaries and expenses;
- financial control.

Managerial Capability

Where such an institutional framework exists, management can concentrate on efficient use of human and physical resources with a clear understanding of the role of the department and its goals. Managerial capability requires:

- the existence of an up-to-date inventory;
- works to be effectively planned, programmed and monitored;
- the budget to be linked with actual costs and the ability to disburse;
- effective cost control;
- adequate plant and equipment to be available and effectively utilized;
- the availability of materials as required.

Technical Capability

Without technical resources, an institutional framework and management expertise are of limited value. Sufficient numbers of competent staff at all levels are required by any organization. Lack of competence, at any level, will effect efficiency, but it is particularly important at the lower levels of responsibility for plant operators, technicians, mechanics and laborers.

Other technical capability requirements for efficient maintenance management are:

- appropriate criteria for planning;
- materials test facilities;
- effective quality control of all operations;
- implemented pavement assessment and monitoring systems;
- access to research and information.

The Checklist

The checklist was developed on the assumption that there was interdependence between the institutional, managerial and technical capabilities as illustrated in Figure 1. This concept was first developed by management consultant and author John Adair in 1983 to illustrate the interdependence of the man, the task, and the environment within an organization. He attempted to demonstrate that, for an organization to be effective, satisfactory performance in one area cannot be achieved without complementary capability in the others. Sufficiency of each element must be sustainable. It may be that too much attention has been paid in the past to improvements in technical capability without first ensuring that institutional and managerial competence can support this. In many countries, straightforward and relatively short-term assistance to upgrade technical capability may be appropriate, but only if institutional and managerial performance is sufficient. The questions included in the checklist are designed to be answered in the following way:

<table>
<thead>
<tr>
<th>Question</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes (Good)</td>
<td>+1</td>
</tr>
<tr>
<td>No (Bad)</td>
<td>-1</td>
</tr>
<tr>
<td>To some extent (Indifferent)</td>
<td>0</td>
</tr>
</tbody>
</table>
It was hoped that by coding answers in this way, it would be possible to analyze the results from the checklist numerically to obtain a quantified assessment indicative of maintenance capability.

In order to test this approach, checklists were completed for road maintenance projects in ten countries with GNP/capita ranging from just over US$200 to in excess of US$3000. Information recorded was based on the capability of the maintenance organization being assisted before the project was undertaken. If the number of “+1” (good) scores in each category was added together and expressed as a percentage of the maximum possible total score, it was found that there were major deficiencies in all of the maintenance organizations investigated. This is illustrated in Figure 2 which shows that in no case did the aggregate score exceed 50%. It is also clear from Figure 2 that there is no discernable relationship between the checklist score and GNP/capita.

The Institutional, Managerial, and Technical Hierarchy

It is, however, notoriously more difficult to effect institutional improvements than to introduce specific managerial or technical advances. For example, the problem of relatively low pay for government employees and poor motivation, particularly acute in developing countries, has proved to be intractable, although it is clearly an important factor influencing the performance of maintenance departments. It seems likely that improvements at the institutional level are prerequisites to improvements in management and technical capability. The results from the checklist tend to support this hypothesis, since most of the countries evaluated failed to achieve a high enough institutional score to provide the basis for investing in managerial and technical improvements.

Considering again the relevance of the Adair model in Figure 1, it is clear that this does not explain fully the relationship between the three elements. The hierarchical nature is better illustrated in Figure 3. Sufficient institutional capability is required to support and sustain managerial capability which, in turn, is a pre-condition for sustained improvements in technical competence.

Use of the checklist is clearly subjective and the answers obtained refer only to a particular time. As such, they will be influenced by the effects of recent maintenance or technical assistance projects which may only be providing temporary improvements in the capability of the maintenance organization. However, it is believed that use of a checklist can greatly assist in the better definition of those areas of the organization which are deficient, and to ensure that aid to the maintenance sector is of the kind which has the greatest chance of success.

![Fig. 1 Adair model applied to a maintenance dept.](image-url)
Fig. 2 Questionnaire results

Countries in order of increasing GNP/capita

Fig. 3 Interdependence of institutional, managerial and technical capabilities
Road Maintenance Questionnaire

1. INSTITUTIONAL CAPABILITY

1.1 Legal powers

1.1.1 Is the responsibility for road maintenance legally defined?
1.1.2 Are all roads the responsibility of the maintenance department?
1.1.3 Are the legal powers understood?
1.1.4 Are the powers adequate?

1.2 Administration

1.2.1 Is there an administrative structure capable of maintaining roads?
1.2.2 Is there an unambiguous chain of command?
1.2.3 Are responsibilities defined?
1.2.4 Are staff aware of their responsibilities?
1.2.5 Are decisions independent of the influence of negatism, favoritism, graft or corruption?

1.3 Human Resources

1.3.1 Are there sufficient personnel available?
1.3.2 Are they adequately trained?
1.3.3 Are they adequately motivated?
1.3.4 Is there an internal training scheme?
1.3.5 Are there operations manuals?

1.4 Budget

1.4.1 Is a budget awarded?
1.4.2 Is it adequate?
1.4.3 Can it be relied upon?
1.4.4 Are operations independent of foreign exchange constraints?

1.5 Financial Control

1.5.1 Does full financial control reside within the maintenance authority?
1.5.2 Are accounts independently audited?

2. MANAGERIAL CAPABILITY

2.1 Inventory

2.1.1 Does it exist?
2.1.2 Is it up-to-date?
2.1.3 Does it cover location and classification of all roads and structures?

2.2 Planning and Programming

2.2.1 Is work programmed according to defined priorities?
2.2.2 Are the costs and benefits of programs assessed?
2.2.3 Is programming done within a plan designed to preserve or enhance the network in the medium/long term?
Assessment of Maintenance Capability - Case Study

2.2.4 Are there specifications for work?
2.2.5 Are specifications achieved in practice?

2.3 Budgeting

2.3.1 Is there a regular and formal budgeting process?
2.3.2 Is this related to actual costs and the ability to disburse?

2.4 Cost Control

2.4.1 Is work done measured and costed?
2.4.2 Are costs realistic in terms of overheads, equipment, materials and labor?
2.4.3 Is cost information collected centrally and used for budgeting purposes?
2.4.4 Is there a physical inspection and audit of work done?
2.4.5 Is productivity measured?

2.5 Plan and Equipment

2.5.1 Is there a fleet of plant and equipment of the size and composition required?
2.5.2 Is the availability adequate?
2.5.3 Is the utilization adequate?
2.5.4 Are the workshops and stores adequate to support it?
2.5.5 Is there an organization capable of managing the fleet cost effectively?
2.5.6 Is adequate financial provision made for replacement and repair?

2.6 Supplies

2.6.1 Are materials available as required?
2.6.2 Does an adequate system exist for ordering and stockpiling road maintenance materials?

3. TECHNICAL CAPABILITY

3.1 Planning Criteria

3.1.1 Are the criteria upon which road maintenance planning is based constantly under review?
3.1.2 Do strong links exist between those responsible for road maintenance planning and those responsible for:
   3.1.2.1 design and construction?
   3.1.2.2 traffic surveys and forecasting?
   3.1.2.3 road safety?

3.2 Materials

3.2.1 Are the properties of materials used fully understood?
3.2.2 Are there adequate testing facilities?
3.2.3 Are materials of the right quality available?
3.2.4 Are appropriate materials always used?
3.2.5 Are testing methods appropriate and carried out at the appropriate frequency?

3.3 Quality Control

3.3.1 Is quality control of products and materials adequate?
3.3.2 Is quality control on site adequate?
3.4 Condition Measurement

3.4.1 Are roads inspected systematically to determine maintenance requirements?
3.4.2 Are physical measurements made of road conditions to determine maintenance requirements?
3.4.3 Are condition measurements made using sophisticated or high-speed instruments?

3.5 Field Monitoring

3.5.1 Is there any systematic monitoring of:

3.5.1.1 quality of work?
3.5.1.2 material quantities used?
3.5.1.3 man-hours spent on job?

3.5.2 Do the results of any monitoring feedback into the future planning process?

3.6 Research and Information

3.6.1 Is there adequate access to current work on road maintenance from other maintenance organizations or international research centers?
3.6.2 Is research on road maintenance currently carried out within the organization?
3.6.3 Are new techniques and practices introduced as a result of research results?
Before 1977, Sri Lanka had a government which favored the public sector, and as a result, the private sector construction industry declined. The industry grew at 7% in 1974, but in 1977, it declined by almost 10% in spite of public sector emphasis on house construction. The industry was regarded as a resource consuming, rather than a resource producing activity, and there was little stress put on infrastructure development. Following a change of government in 1977, economic policies were completely reversed; trade and import restrictions were removed and price controls relaxed. In a bid to achieve an economic take-off, power, irrigation, housing and highway projects were undertaken, and the moribund private sector construction industry was suddenly required to expand. The construction industry workforce increased from 100,000 in 1977 to 229,000 in 1983, about 7% of all employment.

The demand for more construction activity produced shortages of materials and of skilled workers. Construction costs increased by from 50% to 100% between 1977 and 1979, and wages of tradesmen went up by a third. To further decrease the local industry’s capacity, the migration of skilled workers to the Middle East continued. The Government of Sri Lanka realized while putting together their 1979-83 Medium Development Plan that unless more skilled construction workers could be produced, the Plan could not be completed.

Based on an analysis of the Development Plan and other probable private sector construction, plus a manpower survey, it was estimated that there was a need to train about 45,000 new entrants in basic construction skills, to upgrade the skills of a further 9,600 tradesmen, and to train 1,800 mechanical equipment operators and 900 works supervisors. Training was also required for 80 experienced senior works supervisors in work planning and management.

Tradesman training in Sri Lanka had been either by several years of apprenticeship with a Master Craftsman, or by a two-year Crafts Course in masonry or carpentry at one of 13 Junior Technical Institutes. The total output from both these sources made up for retirement from the industry, but could not help towards the expansion required, especially as the almost 60,000 to be trained were wanted within about three years. Within the time available, it would not have been possible to build all the training centers necessary, so that whatever was to be done would have to be as far as possible in existing buildings. There would also not have been the time to produce enough new instructors to carry out the training, and maximum use would have to be made of the existing teaching staff at the Junior Technical Institutes, plus a further eleven Technical and Polytechnical Institutes. In 1980, the Government of Sri Lanka and the World Bank planned a project to provide construction industry training over three years. The project commenced in 1981 and was expected to end in 1984, but was extended to end in 1986. It has been followed by a second vocational training project to build on the results of the first.

To meet the training targets, it was obvious that traditional ways of construction training would have to be radically changed, especially as the facilities previously producing 1,000-2,000 tradesmen a year would now have to produce ten times as many. Using a detailed analysis by trades experts of the actual skills required by the principal categories of construction workers (masonry, carpentry, plumbing, electrical wiring, steel fixing and barbending), it became apparent that new entrants could acquire sufficient skills for first employment by a Basic Skills Module made up of ten weeks of institutional training, followed by ten weeks of controlled on-the-job training. After a period of employment, the new tradesman could move on to a higher level of skill by going through an Advanced Skills Module, lasting from six to eight weeks, depending on the trade. The Advanced Skills Module was also suitable for those already in the industry to update and upgrade their traditional training.

Since employable tradesmen could be produced after only ten weeks in a training institute, instead of two years traditionally, the necessary tenfold increase in output was possible with the same buildings and staff. Only the follow-on ten weeks of on-the-job training called for extra resources, and most of these were supplied by employers, monitored by a small group of inspectors. The only major extra facility needed was an equipment operators’ training center, because operator training had not previously been done in Sri Lanka. Each Basic Skills Module student was given a handbook to use as a reference during and after training, and a tool kit free of charge on successful completion. The training was continuously assessed, and a daily diary and work experience schedule had to be completed during on-the-job training. Living allowances were paid for the twenty weeks of training.

* Although a proportion of those trained later went to the Middle East, this was a substantial benefit to Sri Lanka. A Sri Lankan working overseas sends 80% to 90% of his earnings back home. In 1983, foreign exchange remittances of Middle East workers at US$290 million, were the second largest source of foreign exchange earnings after tea exports (US$353 million).
and, thereafter, employers were expected to give a further 30 weeks of on-the-job training, which was monitored, although no allowance was paid.

Before this project, training given by different institutions varied in content and standard, and employers found it difficult to assess the skills of new recruits. To help overcome this, standard specifications were agreed between different government ministries, and their use was recommended to private industry. Training was tied to these specifications, and a National Skill and Trade Testing system set up for the main trades. The modular training given under the project was sufficient for students to pass their trade test, and so employers had a guarantee of their abilities.

Progress and the effects of training were monitored throughout. Three tracer studies were done in 1983, 1984 and 1985 to evaluate the performance of students in industry. These were followed by an impact assessment study in 1987 to ascertain trainee attitudes, work quality and wages. It was found from these studies that the quality of the tradesmen trained under the modular system was at least as good as those trained in the traditional way, and in some respects was better. About 60% of those trained were being paid at usual average rates or above, which indicates satisfactory performance.

Because of a reduction in demand for construction, due to a slowdown in the economy, targets for training were reduced during the project. In the end, about 38,000 were trained, a reduction of about 40% in tradesmen, but an increase in the number of operators, supervisors and works managers trained. The average cost per person trained was found to be significantly lower than for the traditional methods.

The whole program was under the control of one Ministry, although six different ministries and about 13 different departments of the government were involved. This could have been a recipe for inactivity, but a Secretaries' Committee for the Construction Industry was set up on which all different agencies of the government were represented. This committee dealt with liaison and government policy as it affected the industry and the training project. The day-to-day administration was done by a project unit.

The project unit received guidance from the Secretaries' Committee and from the National Steering Committee. The latter had on it representatives from all parts of the construction industry in both the public and the private sectors. It set up five sub-committees to look into and, if desirable, recommend changes in: tender procedures, contractor prequalification, conditions of contract and specifications; training for upper- and middle-management, quantity surveying and quality control; contractors' associations; design economics and the construction industry; and strategic planning for the industry. The aim of this wide review was to coordinate all aspects of the whole industry, public and private, so as to increase the effectiveness of the training given, and to reduce the chances of conflicting standards and practices.

Several interesting aspects of this project might be applied elsewhere in other projects. They are:

- the target output numbers were clearly set at the outset, and had been based on a realistic assessment of current conditions. When conditions changed, forecasts were quickly reassessed and outputs revised;
- the scale of training to be given was also clearly specified, so as to give essential skills—and only those skills—required to overcome the shortages that existed;
- it was understood that for training on this large scale to be effective, other aspects of the industry needed to change. These included trade testing and the status of construction workers in society, as well as the work of the various specialist sub-committees set up;
- the project was put under the control of full-time local staff who were given clear guidance and responsibilities by the steering committee, who represented all interested parties in both the public and private sectors;
- the Sri Lankan Government coordinated the conflicting interests of different ministries and departments through the Secretaries' Committee of the most senior civil servants. In this way, interministerial conflict was resolved without affecting the progress of the training;
- the products of the training were monitored over the whole period by follow-up and impact surveys, and the results of these were used to review training content and methods, or to revise the numbers to be trained; and
- there was a clear and obvious need for the training, which was recognized by everyone.

There is little doubt that the success of this training effort under difficult circumstances was mainly due to the determination and commitment of one or two individuals in the Sri Lankan Government, who first realized the urgent need for training on this scale, and then communicated their commitment to others.
Topic C: Case Study
U.K.: Evaluation of Incentives for Efficiency in Road Maintenance Organizations

Summary

Bonus incentives schemes for highway maintenance labor have been used and developed by highway authorities in the United Kingdom (UK) since 1960. Since 1981, the local highway authorities have been required to carry out road maintenance on a contract basis, in partial competition with private contractors.

This study reviews and evaluates the productivity and cost effectiveness of direct labor operations of the country highway authorities in the UK. It evaluates the performance indicators for four of these departments. More generally, the study assesses the applicability of the UK experience to the developing countries, given the often very serious weakness in public administration in many of those countries.

In the 1960s, bonus incentives were mainly introduced in high wage areas to facilitate the retention and recruitment of labor. By 1968, some 25% of highway authorities had introduced incentive schemes. Common design principles for such schemes had been established and there was pressure from the Central Government on all local authorities to tie future pay increases to productivity. The 1970 Marshall Report showed that highway authorities could obtain considerable cost savings from bonus incentive schemes and recommended their adoption. By 1972, highway authorities throughout the UK had adopted bonus incentives schemes for direct labor maintenance operations.

The incentive scheme commonly adopted was the "payment-by-results" type providing a varying amount of bonus according to the amount of work claimed by the employee. Standard minute values (SMV), derived from method-time-measurement techniques, were assigned to discrete elemental activities, but they did not have a direct relationship with commonly recognized roadwork operations.

Initially, highway authorities obtained considerable cost savings and marked increases in productivity from the adoption of payment-by-results incentives schemes. Over time, defects in the design and application of some schemes eroded both their effectiveness and the related productivity gains. Owing to multiple work study values and laborious operating procedures, the relationship between bonus earning performance and productive output inevitably deteriorated. Most importantly, there were no overall compelling incentives for management to improve cost effectiveness through planning, programming, and control of work.

Some highway authorities, however, realized that the work study data upon which the incentive schemes were formulated had other uses. This led to the development of the computerized RATE system for estimating, resource allocation, and standard costing.

The concept of combining elemental values to form composite work values, similar to the items in a Schedule of Rates or Bill of Quantities employed in the RATE system provided the foundation for the 'pre-targeted' or 'pre-evaluated' bonus incentive schemes. But it was the combination of increasing public dissatisfaction and the demands of legislation which prompted the change from the post-work measurement 'payment-by-results' incentive schemes, to 'pre-targeted' schemes. The latter require the scope of the work to be predetermined and provide a direct relationship between productivity and unit costs.

For some time the efficiency of the Local Authority Direct Labor Organizations (DLOs) had been questioned and several studies had concluded that they should be established as public commercial enterprises in competition with the private sector. This led to the DLO Legislation (effective April 1, 1981), which requires a Highway Authority Direct Labor Organization to:

- maintain separate accounts of income and expenditure;
- tender competitively for some work and submit estimates for the remainder of its work;
- achieve a set rate of return on the capital employed;
- provide and publish annual reports with detailed records on its financial performance;

and also vests in the Secretary of State for the Environment the power to close down a loss-making enterprise.

* Brian E. Cox, Transportation Department, Operation Policy Staff, The World Bank, Washington, D.C.
The amount of highway work initially subjected to competition was very small and, although successively increased, comprise less than half of all the work carried out by direct labor. Competition, to some extent, has been diminished by the contract procedures adopted by some authorities. Proposed legislation is expected to increase the amount of open competition, extend the range of local authority services subject to compulsory tendering, and reduce restrictive contract conditions which local authorities can impose.

The incorporation in DLO Legislation of all types of highway work within a single accounting category and the consequent opportunity for DLOs to cross subsidize between competitive and non-competitive work is a matter of contention between the local authorities and private contractors. The proposed increase in the amount of work subject to competition is likely to reduce the opportunity for cross subsidization.

The requirements of the DLO Legislation have already produced substantial changes in the organization and execution of highway maintenance. The DLO Management has been able to improve the cost-effectiveness of its operations through better prediction and programming of resource requirements. The recommendation associated with the DLO Legislation that all work should be described in accordance with a Schedule of Rates or Bill of Quantities has necessitated the quantitative pre-determination of maintenance needs by the 'client' highway authority. As the competition becomes keener, the DLO management must think and act commercially, since the survival of the DLO will eventually be determined by its performance as a contractor.

The profits from DLO operations may not necessarily be spent for the benefit of DLO and are to be returned to the general exchequer. As a result, the actual rate of return on capital achieved by a DLO is more a reflection of the DLO's accounting capability than its efficiency or cost-effectiveness. The target rate of 5% prescribed by the DLO Legislation equates to an average 1.25% return on turnover, which is far below an acceptable margin for a private contractor. The rate of return requirement has focused attention on items that suppliers following a successful tender by its DLO, a public employment conditions superior to those offered privately. About 12% of local authorities have adopted discriminatory contract compliance policies which the central government regards as an abuse of contractual powers. New legislation has been proposed to restrict such contract conditions. All of the authorities' studies had considered cross-subsidization between competitive and non-competitive work, but had been deterred by the risk of detection and publication of an adverse report by auditors. One of the countries had adopted price bargaining with material suppliers following a successful tender by its DLO, a marked departure from traditional local authority purchasing procedures.

The study showed that the DLO Legislation has produced a significant change in the attitude of the management and the work force because of the requirement to compete, to execute activities contractually, to control costs, and to monitor cost-effectiveness. The implementation of incentive schemes linking productivity with real output has demanded a change in the attitude of the work force and its trade unions at the local level. This has led to improvements in work discipline, team effort, and the abandonment of restrictive practices, such as the 'no redundancy' agreements.

Competitive pricing of work, accurate assessment of resource requirements, and close monitoring of income and expenditure, has encouraged the development of locally operable micro-computer systems for estimating and accounting, with rapid feedback revealing performance at all levels of an organization. Micro and mini-computer based RATE type estimating systems interfaced with DLO accountancy systems have been installed by six of the seven countries studied. Competition with DLOs, however, has had an adverse effect on some small private contractors through the withdrawal of assistance previously provided freely by the highway authorities.

The private construction industry has alleged that some local authorities are frustrating the intent of the DLO Legislation to promote open competition by manipulating the competition rules and imposing contract conditions unrelated to work performance. The local authorities, on the other hand, maintain that their DLOs are disadvantaged by a restricted market and by mandatory public employment conditions superior to those offered by private contractors. The local authorities have adopted discriminatory contract compliance policies which the central government regards as an abuse of contractual powers. New legislation has been proposed to restrict such contract conditions. All of the authorities' studies had considered cross-subsidization between competitive and non-competitive work, but had been deterred by the risk of detection and publication of an adverse report by auditors. One of the countries had adopted price bargaining with material suppliers following a successful tender by its DLO, a marked departure from traditional local authority purchasing procedures.

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costing and work measurement had increased the administrative and technical work load, it was reported that the separation of client and contractor responsibilities had enhanced efficiency and cost-effectiveness by enabling a clear definition of objectives and corporate identity.

The increased cost-effectiveness obtained from simple productivity-based incentive schemes, improved management systems, and a general awareness of the need for efficiency, has been accompanied by net savings in manpower despite the additional management and administrative requirements. The reduction in the DLO labor force of the four countries evaluated in this study ranged from 7 to 24%. Material costs have been contained by changes in procedures giving DLO management more freedom to directly purchase materials and negotiate with suppliers, and by the use of the RATE intensive construction and rehabilitation activities had more freedom to directly purchase materials and two countries with large DLOs undertaking equipment management more freedom to directly purchase materials and negotiate with suppliers, and by the use of the RATE intensive construction and rehabilitation activities had more freedom to directly purchase materials and negotiate with suppliers, and by the use of the RATE intensive construction and rehabilitation activities had

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The power of the Secretary of State to close down loss making DLO, similar to the bankruptcy of a private contractor, has been exercised at least once with respect to the housing construction DLO of a London Borough. Various indicators were examined to determine the effect of the DLO legislation of cost-effectiveness. It was found that the most competitive of the four countries studied had increased its labor productivity by 18% and the productive time of its labor force by 29%. Since the implementation of the DLO legislation, increases in the value of work per road worker (ranging from 24 to 32%) had been registered by all four countries.

Changes in the composition of road maintenance costs were also examined for the four countries studied. The two countries with large DLOs undertaking equipment intensive construction and rehabilitation activities had achieved reductions in plant and vehicle costs, whereas the two countries with smaller DLOs mainly employed on labor-intensive routine maintenance activities, had achieved reductions in the labor cost component, suggesting concentration in each case on those areas where economies would most enhance DLO competitiveness. The availability of data for examination of the effect of the DLO legislation on unit prices was limited by contractual confidentiality, but three countries supplied some information, and national price indices were supplied by the Department of Transport. The study confirmed that open competition had restrained unit prices and so increased the value for money obtained from public expenditure.

An assessment was made for the potential for the further improvement and the effect of the measures taken so far to increase competition. It was found that the total highways expenditure in 1984/85, about 46% was expended by County Council DLOs, and that only about 9% of this had been subject to open competition, corresponding to about 20% of the total DLO expenditure. Changes in the competition rules had some effect—the proportion of DLOs with a record of minimal competition (0%-5%) decreased from 35% in 1981/82 to 9% in 1984/85, while the record of DLOs competing for more than 30% of their work, increased from 0% in 1981 to 12% in 1984/85. Although the DLO legislation has enhanced cost effectiveness, there is scope for further improvement and additional increases in the amount of work subject to competition will prove beneficial. It is doubtful whether these developments would have occurred without the spur provided by the DLO Legislation.

The experience and knowledge gained in UK with productivity-based incentive schemes for maintenance labor could well be transferred to many developing countries which, due to a low public sector wage
structure, cannot recruit or retain qualified staff or skilled personnel. The economic gains from increased productivity would have to be considerable in order to finance incentive schemes. Portable, user friendly, micro-computer based, RATE-type estimating and accounting systems, whose operation does not require high level accounting or engineering skills, could beneficially be adopted by developing countries that depend on cumbersome, manually-operated budgetary, cost control and estimating procedures. Although the reported experience with contract maintenance is favorable, disadvantages may accrue in some developing countries which do not possess the public service capability to manage contracts or have a sufficiently well-developed contracting industry. A gradual introduction of competition along the lines developed in the UK could effectively promote the strengthening of both the public and private sectors.
Introduction

A "twinning" arrangement has been set up between local authorities in the United Kingdom and Ghana as a small part of the Accra District Rehabilitation Project with the assistance of the World Bank. The objectives of the project are road construction, road rehabilitation, road maintenance, area improvement, municipal revenue mobilization, and the associated institutional development including training.

The components of the project with which Staffordshire County Council are involved are road maintenance, revenue mobilization, and the associated institutional development. The duration of the project was five years, terminating on December 31, 1989.

Twinning can be defined as a professional relationship between an operating entity in a developing country and a similar but more mature organization in another part of the world. The services provided by the latter differ from those of a consulting firm in the following respects:

- "The supplier of TA has operating experience in similar functions."
- "Twinning provides opportunities to integrate TA and training."
- "There is flexibility to alter the work program over time and the possibility of very long-term cooperation."
- "The TA supplier may lack worldwide experience."
- "The supplier may lack experience in the consulting profession."

The major advantage of a twinning arrangement to provide TA is having an operating entity stand behind the TA supplier's work. Thus, the entity that provides the assistance can draw upon its own in-house resources in the relevant functional areas, offering services as needed in the client's complementary functional areas. For example, a supplier entity in a twinning arrangement can train client staff as it trains its own in operating or maintaining equipment. Also, the experts in the field have had practical experience in jobs similar to those which the client's staff are performing. For a client, a twinning arrangement means that the technical assistance comes from a very credible source—another entity actively and successfully engaged in the same type of operations.

Description of Local Authorities Involved

Accra City Council (ACC) is in many respects similar to Staffordshire County Council (SCC). Both authorities have similar though not identical statutory responsibilities, and their organizational structures are based on a common legal and administrative tradition. Officers and members from either authority visiting the other are, to a considerable extent, familiar with the powers, duties and systems operating in the other authority.

Although ACC is largely an urban authority while SCC includes urban and rural areas, in many respects they are comparable. Both authorities have similar problems although very different in scale. Each authority considers that there are services which they would wish to make available to the people of their areas, but for which the resources are not available. Both authorities have judged that there need to be increased expenditure on highways and transport infrastructure, both have areas of housing which require improvement or reconstruction. Each authority has a population slightly in excess of 1 million (Accra 1.2 million, Staffordshire 1.02 million). Both authorities have over 600 schools.

As an indication of the scale of SCC's operations and the resources available to the County Council, the annual revenue budget for 1988/89 exceeds £620 m, and the capital budget £33 m. The major functions being education, highways and transportation, police and the provision of social services, and various other services from the administration of justice to the provision of small holdings, libraries, and museums.

Accra District Rehabilitation Program

In June 1984, a World Bank Mission appraising the Accra District Rehabilitation Project included a local...
government officer from Staffordshire County Council provided with British Government financial support to consider whether a twinning arrangement could contribute to the project. Staffordshire was subsequently asked whether it was prepared to be involved. After discussions with the Accra City Council and the World Bank Mission, the County Council agreed to take part in a Twinning Agreement. Staffordshire was informed that the arrangement would be experimental, in that there was little previous experience of multi-functional twinning. They were asked whether they would be prepared to be evaluated during and at the end of the project to see whether the twinning had been successful and what lessons, if any, could be drawn from the experience. The County Council was happy to agree to such an arrangement, the details of which followed very closely Technical Paper No. 23. The main points of the arrangement were that Staffordshire staff would spend time in Accra, split between long-term secondments working in Accra on specific topics, and short-term visits providing supervision by the Staffordshire staff, to assist and advise wherever possible. In addition, Accra staff would spend time in England, either with Staffordshire, or with other organizations in the U.K. It was envisaged that Staffordshire would be prepared to act as host to the staff and in the event of them having any problems would use its best endeavors to ensure that those problems were dealt with.

The main features of the project are as follows:

- Infrastructure Rehabilitation
- Road and Drainage Rehabilitation and Maintenance
- Basic Infrastructure Upgrading in East Maamobi
- Resource Mobilization
- Property Revaluation
- Municipal Revenue Mobilization
- Resource Mobilization at the Municipal Level

The Developing Situation 1984 to 1989

The secondments to Accra by Staffordshire Staff were split into short-term and long-term. There have been short-term visits amounting to approximately 30 man-weeks, long-term secondments of 48 man-months, (2 Officers) relating to Highways, and 18 man-months (1 Officer) relating to financial matters. The project provisions originally anticipated two further full time officers. The time spent in England by Accra Officers and members was similar, at approximately 30 man-weeks. The twinning provision within the original project has not been fully used.

The operational situation in Accra was that both of the components with which the twinning was involved showed a great improvement. There was a substantial increase in the roads being maintained and the revenue collected. Equally impressive was the improvement in morale of the workforce of the organizations. Whether or not this can be attributed to the twinning arrangements must be determined after careful evaluation.

The institutions are now performing specific tasks more effectively, and there are individuals within the organizations that are better able to carry out those tasks as a result of the period of training and secondment under the project. These secondments have been applied both to Staffordshire and to other institutions in England. A critical factor has been the strong political leadership of ACC. Whether the institutions have been sufficiently strengthened to enable their performance to be sustained if key individuals were to be promoted or to leave the organizations is uncertain.

Twinning Arrangements - Advantages

As the arrangement is essentially long-term, institutional links have been built up between SCC and ACC and between individuals within the organizations. Once the formal project is complete, it is likely that the links will survive and that ACC staff in England will continue to be welcomed to the County Council. In addition the British Council and independent training organizations are recognizing the links that exist and are seconding Ghanaian Staff in training in England to SCC.

The SCC-ACC links are now sufficiently well established for SCC views to be sought on problems and topics not necessarily connected with the project but relating to local government and public administration generally.

The early visits to England under the project were longer-term (three months) not relating specifically to ACC or SCC but to a general topic or area. As the project has developed, visits have been targeted more specifically on particular topics—budget construction, road maintenance, traffic engineering, quality control, debt collection—where the topic and the individual are specifically chosen in the knowledge of the Staffordshire practice and Accra needs. Specifically targeted visits are very cost effective.

The long-term nature of a twinning arrangement means that there can be a reduced risk of an inappropriate transfer of technical assistance or technology. A deeper understanding of the problems, possible solutions and consequences can be achieved when a longer time frame is deliberately chosen.

Once a trust has been built up between individuals within the institutions, it is possible to examine not only successful schemes and systems to see to what extent appropriate lessons can be drawn, but also practices to
be avoided and systems that are no longer applicable. Given the scale of Staffordshire’s operation and the length of time for which it has operated, the experience to be drawn upon is considerable.

The institutional links between like institutions enable the inter-relationship between the political, managerial, administrative, and technical problems to be fully evaluated. The specific links between direct service delivery and revenue collection can be an invaluable aid to performance. The political and institutional implications of an apparently simple technical decision are often apparent to an institution facing similar problems and ought to make the process of institutional development more effective.

The time frame of the twinning arrangement permitted the planning of successive visits to Staffordshire to secure an overview of the process which would not be possible over a shorter time frame. A succession of short-term visits spread over several years at specific points in the Staffordshire financial planning process gives a better insight into the institution and its operation than a view from a single point in time with a description of the parts of the process not current.

By explaining the Staffordshire institutions to Accra City Council staff across a range of functions, Accra staff are able to draw conclusions that may be relevant to Accra which are not apparent to Staffordshire staff.

Twinning Arrangement - Difficulties Experienced

The following are difficulties that Staffordshire and Accra have experienced. To mention them is not to criticize any individuals either in Accra or Staffordshire.

The work involved with the twinning arrangement for those Staffordshire staff based in England is not their main responsibility and at times must take second place to their normal duties. This can cause delays in giving needed advice and assistance. Visits to Accra have to be accommodated within a timetable of work in Staffordshire that may be fixed.

The legal framework under which British Local Government operates is very specific and indeed can change during the course of a twinning arrangement. British staff have to ensure that their activities and the actions of their institution comply with the legal constraints. Any payments made by the County Council are subject to British audit and financial constraints. Staffordshire staff may have little experience working overseas. The time taken to familiarize themselves in the African environment is greater than would be required if the institution had overseas experience prior to the twinning. Accra staff coming to Staffordshire are able to adjust more easily.

Because of the lack of overseas experience, greater demands are put upon both the Accra staff and upon the World Bank supervisory staff. A consultant with overseas experience knows what is expected of him within the terms of reference and what discretions and authority he is able to exercise. The guidance required by Staffordshire, particularly from the World Bank staff, is considerable and must put additional demands upon them.

Changes in personnel in Accra, Staffordshire, or Washington during the course of the twinning can have a considerable impact. Fortunately, there has been a large measure of continuity.

The objectives of a project, or the relative importance of objectives within a project, are not always apparent. Is it more important to incur expenditure as programmed or when it will make the most significant contribution to the project? Should equipment be procured in advance of the institutional development to secure its proper use? Staffordshire’s views are conditioned by its UK practice which may not accord with project objectives. The availability of appropriate staff in England will vary over time.

The establishment of a relationship whereby the Accra staff are not threatened by the existence of visiting “experts” is a crucial task and one where a prior knowledge of the cultural background would have been helpful.

The appointment of counterpart staff is considered by SCC to be of paramount importance to enable the full benefit of the twinning to be achieved. It has been difficult to secure the appropriate appointments in view of the shortages of available qualified staff in Accra.

The project budget contains a provision for training. SCC view is that the technical objectives of the project are comparatively easy to achieve. However, the institutional development needs of the organizations are far more difficult to achieve; only by fully utilizing the training opportunities will the organizations be strengthened sufficiently to enable them to survive as effective organizations, able to meet changing demands, as with the inevitable changes in personnel as existing staff retire, are promoted, or leave for other posts. At present, the organizations are very dependent upon key individuals whose contributions to the organization would be difficult to replace if they were promoted or left the organization. Training in depth is required. The complexity of an urban project such as the Accra project may be inevitable, but the mix of technical objectives such as highway construction within the same project as institutional objections may create the possibility that the more easily measurable and achievable technical objectives are given priority.
However, the visible achievement of some of the project objectives increases the chance of success of the other institutional objectives and an evaluation of the relative benefits of simple or more complex projects would be helpful investigation.

On a more detailed level, the variances in exchange rates can further complicate matters for the Staffordshire County Council.

The Way Forward

An independent external evaluation of the Accra experiment would be useful both to the participants and to others considering a similar project. It may well be that a follow-up to Technical Paper No. 23 would be worthwhile.

It may be fruitful to consider ways of maintaining the institutional links between Accra and Staffordshire once the formal project is complete. The design of World Bank projects to ensure that the priority of institutional development is maintained while not losing the undoubted benefits of being part of a viably successful project may be usefully investigated.

The possibility of linking an institution such as Staffordshire, which at the outset of this project had limited overseas and World Bank experience, with consultants familiar with World Bank procedures and the Country concerned, should be explored and evaluated.

The individual bonds made in Accra and Staffordshire are highly valued, and participation in the project has been a stimulating and rewarding experience.
Road Maintenance Policy Seminars
Agenda

Day 1

9:15 - 10:00 am  Opening session
-Introduction of Moderator: World Bank
-Official Opening: Minister of Transport and Communications
-Welcome: ECA
-Opening: SSATP
-Operating rules for seminar: EDI

10:00 - 10:45  Introduction and overview
-A policy Foundation for Better Roads: World Bank
-Open Discussion: World Bank

10:45 - 11:00  Coffee

11:00 - 12:15 pm  Open Discussion (continued)

12:15 - 1:45  Lunch

1:45 - 2:00  Policy Action Planning: ESAMI/CDG
-General overview and introduction; Linkages to Phases II and III of Road Maintenance Initiative

2:00 - 2:20  Topic 'A' - Planning Financing and Management
-Policy Issues and Options: World Bank

2:20 - 3:45  -Discussion and Summary of Key Issues
-Identification of subjects for Workgroup discussions

3:45 - 4:00  Coffee

4:00 - 4:20  Topic 'B' - Operation and Management
-Policy Issues options: Adviser

4:20 - 5:45  -Discussion and Summary of Key Issues
-Identification of subjects for Workgroup discussions

7:00 - 8:31  Cocktails
Road Maintenance Policy Seminars

Agenda

Day 2

9:00 - 9:30  Topic 'C' - Human Resources and Institutional Development
            - Policy Issues and Options: EDI

9:30 - 11:00 - Discussion and Summary of Key Issues
               - Identification of subjects for Workgroup discussions

11:00 - 11:15  Coffee

11:15 - 12:30 pm  Plenary Discussions and Group Workshops
               - General Open Discussion - Topic 'A', 'B' and 'C'
               - Group formation and Allocation of Workshop Issues
               - Groups appoint Chairmen and Rapporteurs

12:30 - 2:00  Lunch

2:00 - 4:00  Workshops
             - Specific Topics and Issues (with assistance from Advisers and resource persons as requested by groups)

4:00 - 4:15  Coffee

4:15 - 5:45  Plenary
             - Workshop reports
             - Guidelines for Policy Action Planning: CDG

7:00 - 9:00  Cocktail Reception
Road Maintenance Policy Seminars

Agenda

Day 3

9:00 - 9:30 am  
Policy Action Planning  
Guidelines for Policy Action Planning (continued): CDG

9:30 - 10:00  
-Demonstration of Use of Guidelines and Approaches to Policy Action Planning: ESAMI/CDG

10:00 - 10:15  
-Discussion of Guidelines and Road Maintenance Initiatives phase II and III

10:15 - 11:00  
-Country Teams - Policy Action Planning  
(guidance available from Advisers and resource persons if requested)

11:00 - 11:15  
Coffee

11:15 - 12:30 pm  
-Country Teams - Policy Action Planning  
(guidance available from Advisers and resource persons if requested)

12:30 - 2:00  
Lunch

2:00 - 2:30  
Plenary  
-Open Discussion and Clarifications of Policy Action Planning if necessary

2:30 - 4:00  
-Country Teams - Policy Action Planning  
(guidance available from Advisers and resource persons if requested)

4:00 - 4:15  
Coffee

4:15 - 5:45  
-Country Teams - Policy Action Planning  
(guidance available from Advisers and resource persons if requested)

8:00 - 10:00  
Seminar Dinner
Road Maintenance Policy Seminars

Agenda

Day 4

9:00 - 11:00 am
-Country teams - Reports to Plenary
-Results of Policy Action Planning (level of Detail at country Team’s discretion)
-Country Team perceptions of Policy Action Planning process and Phases II and III of RMI

11:00 - 11:15
Coffee

11:15 - 12:30
Synthesis of Seminar including indications regarding Phases II and III and next steps for progress (SSATP)

12:45 - 2:15
Lunch
-Guest Speaker (Minister of Transport and Communications)

Final Plenary

2:15 - 3:00
-Open Session (subjects to be proposed by participants)

3:00 - 4:00
-Evaluation of Seminar

4:00 - 4:45
-Coffee and Formal Closing of Seminar
SUB-SAHARAN AFRICA TRANSPORT PROGRAM
ROAD MAINTENANCE INITIATIVE

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